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This Week in . . .

THE IRON AGE

Editorial

No Retreat Behind the Lines 35

Technical Articles

Electric Steel Plant Refractories 37
Graphite as a Lubricant 44
Lead and Tin Undercoats for Silver Plating 47
Induction Brazing 75 mm. Shell Adapters 52
Titaniferous Adirondack Ores 53
Measuring Furnace Atmospheres 60
Ingot Mold Stools 63
New Equipment 65

Features

Assembly Line 70
Washington 74
West Coast 78
Fatigue Cracks 82
Dear Editor 84

News and Markets

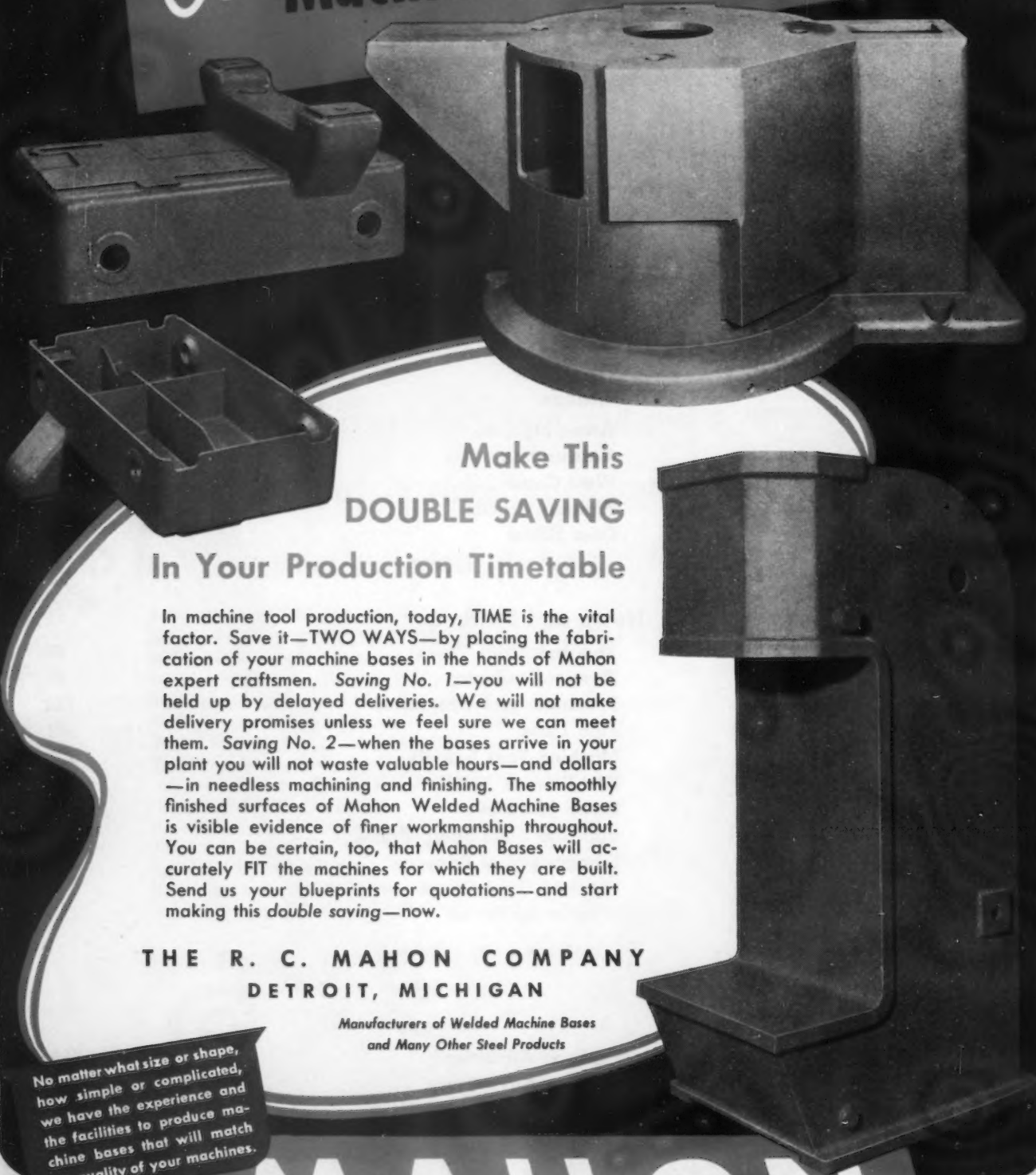
This Industrial Week 86
News of Industry 89
Personals and Obituaries 129
Pipe Lines 131
Machine Tool Activity 132
Non-Ferrous Metals 133
Scrap Markets 134
Iron and Steel Scrap Prices 136
Comparison of Prices 137
Finished Steel Prices 138
Warehouse Prices 140

Products Advertised 176
Index to Advertisers 219

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No Retreat Behind the Lines

WHEN an army fights with one that is better equipped, strategic retreats are in order. But there must be no retreats in American industry, behind the lines.

There is every reason why General MacArthur and his men, outnumbered ten to one in manpower and munition power should have retreated to a shortened line. But American industry cannot and will not shorten its lines. They must be constantly lengthened.

The military might of a nation does not consist of its army and its navy nor of their existing armament and munitions. These things measure present but not potential fighting power. To get potential fighting power, you must add to these the productive capacity of the nation's industry.

When our producing capacity becomes fully geared to war, we will be the most powerful nation on earth. That is axiomatic, because our industrial capacity is greater than that of any other nation. But until we do get geared up we shall have to fight defensively rather than offensively and American soldiers and sailors will be killed and wounded in the process.

The longer it takes us to get geared up so that every man and every machine is contributing all that it possibly can, the greater will be our total casualties.

That is something for every man and woman in American industry to think about. Ask yourselves: "How many American boys will die or be wounded because I am not doing all that I am capable of doing?"

If you are a plant manager or the head of a company that has equipment capable of turning out products for our armed forces but that equipment is idle or doing something else, ask yourself that question. For if speedier action on your part in conversion will shorten this war just by one hour, you may be directly instrumental in saving a hundred lives. And people get medals for saving just one.

If you are doing eight hours of work a day and are capable of doing ten, that two hour difference is not measured in dollars of wages but in losses on the battlefield. Two hours a day from American industry now may well mean two hundred thousand less casualties when the war is over and the books are balanced.

If you are a labor leader and are tempted to call a strike, reflect upon what you are doing to our boys at the front when you shut down a plant. For you are doing a dirtier job than the Japs or the Nazis are doing. They are fighting our soldiers face to face and you are shooting your own countrymen in the back from behind the lines.

"Saving Democracy" is a phrase that is a bit hard to get hold of and bring home to oneself. But you can sink your teeth into the thought that saving American lives is sure to result if you determine to do that little or big bit more which is represented by the difference between what you are doing and what you *might* do.

J. W. Van Dusen



Men, Steel and MORE Steel

Men, steel and *more* steel point the way to victory. Men who build the machines of war—men who use them at the fronts. Steel that provides the machines which make the machines of war—steel that is giving American fighters the finest equipment on every battle front. Never before in the history of war has steel been so essential in quality and in quantity.

The capacity of American steel mills today is 88,000,000 tons—almost double that of the last war. New capacity now being constructed will add millions of tons in the very near future. The machine tool industry doubled its 1940 output in 1941, and enormous expansion is under way at this moment. This war is a race to make things *of steel, by means of steel.*

It is because of steel used in construction that munition plants of great size are completed in the shortest

possible time. It is because of steel that our motorized armies, taking with them full equipment including great mobile field guns, move in less than an hour the distance covered in a day by General Grant. Better steels, in greater quantities have given us 60-ton, high-speed moving fortresses in place of low-speed, 6-ton tanks—bomb loads of 10,000 lb. instead of 40 lb.—machine gun fire of 1,500 rounds per minute in the place of 600—more air ships in a single month than we built during the first world war—and, because of steel we are building naval and merchant ships at the greatest pace ever undertaken by man.

Inland men are working day and night—the Inland mills are operating at capacity—new steelmaking facilities are being added—so that American industry and America's fighting men will have better steels, in greater quantity, to win this greatest-of-all mechanized wars.

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Electric Steel Plant Refractories

By J. H. CHESTERS

Central Research Department,
United Steel Companies, Ltd.,
Stocksbridge, England

THE use of of induction furnaces, illustrated in Figs. 7 and 8, for metal melting has raised many difficult problems in the production of durable linings. Apart altogether from the question of refractoriness and slag resistance, the lining must resist the severe strains imposed on it by the rapid rate of heating and by the steep temperature gradient between the molten metal and the coil. Acid and basic linings are now available that are reasonably durable under normal conditions and which are unlikely to fail suddenly under brief periods of abnormal treatment such as may occur due to a super heat. The work that has been done on linings may be subdivided according to whether it deals with the old horizontal ring-type, Kjellin or Röchling—Rodenhauser; the Wyatt type used for non-ferrous work; or the coreless induction furnace as now used for steel making.

The first horizontal ring-type furnaces used for steel making were lined with silica bricks. The lining was not very durable and the charge tended to pick up silicon from the lining. Later, dead burned or electrically fused magnesite was employed. Dolomite bonded with tar has also been used. The solid ring or template was placed in the furnace as a former, around which the lining material was rammed. The grading of the lining was carefully controlled and the pitch used to bond it had to comply with certain specifications, notably a maximum moisture content of 1 per cent. The magnesite linings made

... Induction furnace refractories, basic, acid and neutral, and the merits of monolithic and brick linings are discussed in this concluding article on electric furnace refractories.

in this way, using a relatively pure magnesia, showed no signs of softening at 3632 deg. F., and gave a metallic ring when struck at the working temperature. They averaged about 400 heats when melting steel and no patching was required for the first 100 melts.

As stated in the introduction, the coreless type, high frequency furnace consists essentially of a crucible surrounded by a water cooled coil, both the coil and the crucible having a circular cross-section. The linings of such furnaces have not, however, been confined to crucibles. Indeed, their use is comparatively rare, their place having been taken by the monolithic type of lining. The different ways in which such furnaces can be lined are briefly as follows:

(1) Pre-formed Crucibles:

These are usually fired and are normally made of fireclay or plumbago (clay-graphite) though other materials, such as magnesite and magnesia-zircon have been used. The life of a fireclay pot when melting steel is usually quite short, say four or five melts. With plumbago crucibles, a considerably longer life is obtained, but there is always the risk of contamination of the charge by carbon from the

pot. Where crucibles are employed, the annular gap between the crucible and the coil is usually filled with zircon sand.

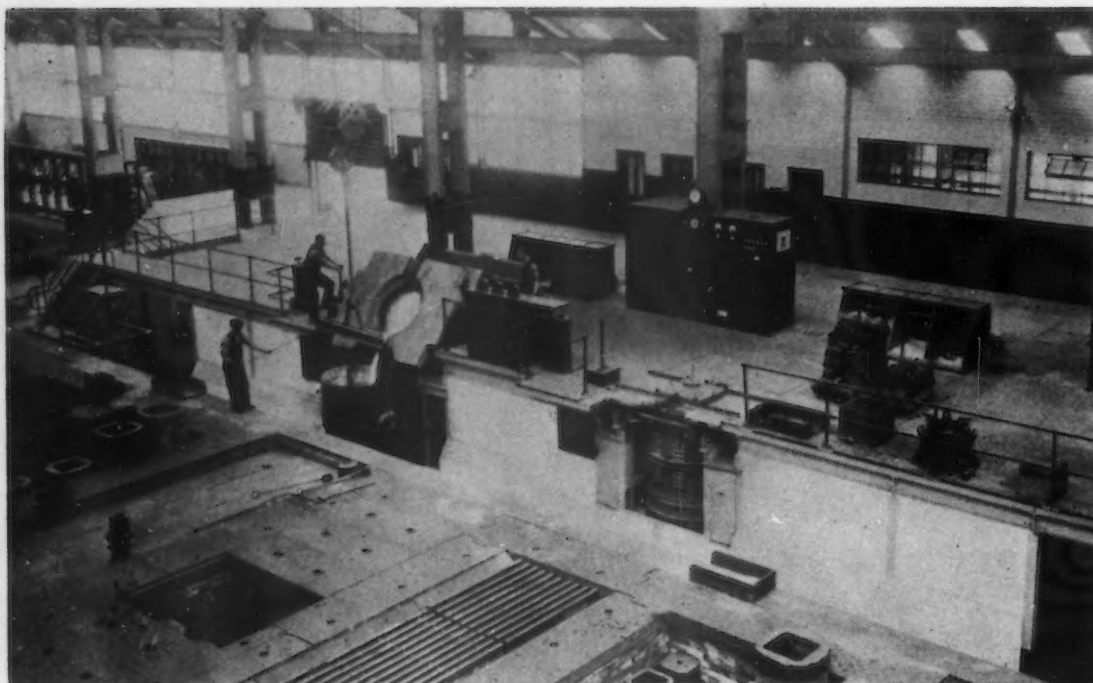
Several workers have attempted to line crucibles, either to increase their life or to avoid contamination of the melt. Thus Northropp refers to the use of graphite crucibles lined with magnesia or zirkite. Other materials, such as zircon, sillimanite and magnesia have been tried in the form of pastes applied to the inside of the crucible. For the most part, however, such devices have been abandoned, partly because the lining wears away quite rapidly and partly because cracking of the lining may result in carbon contamination, even even though the lining as a whole remains in position.

(2) Monolithic Linings, the Steel Liner Method:

This is the most commonly used method for steel-works furnaces. It was developed by Rohn (British Patent 226,801), who described the use of a dry granular material sintered in place by means of the melting of a steel liner. This method, illustrated in Fig. 9, will be described in some detail later in this section.

(3) Monolithic Linings, the Asbestos Liner Method:

Considerable success has been



THIS view of the induction furnace department of an electric steel plant shows a five-ton furnace being tapped, and another beside it during a heat.

obtained, particularly in America, by ramming the refractory between the coil and an asbestos cylinder. The furnace is charged and during melting the reaction between the asbestos and the lining material is sufficient to give adequate sintering.

(4) Brick Linings:

These may be either fired or unfired, and made from acid or basic materials.

Lining Installation with Template

The procedure employed in installing an acid or basic lining in a high frequency furnace in Great Britain is briefly as follows:

The bottom of the coil is first bricked across so as to be essentially "sand" tight, as shown in Fig. 9. If the lining is basic, magnesite or fireclay brick, and if acid, silica or fireclay brick are used. About 5 to 6 in. of lining material is poured onto the brickwork, smoothed out and rammed in position, usually with a rammer having a fairly large head, say 2-in. diameter. A preliminary packing, using a sharp edge tool, insures that no pockets are left in the bottom material. To the beginner, the use of such a tool as a rammer may seem absurd, but experience gained in the early days of induction furnace linings showed it to be essential for the ramming of dry linings.

The steel liner, which is a cylinder closed at the lower end by a curved plate, is then placed on the bottom material and bedded in position. Four wooden spacers are

placed vertically between the coil and the steel liner so as to insure constant thickness of lining. More lining material is now poured into the gap between the coil and the steel template and is rammed in position in layers of 2 or 3 in. at a time. The wooden spacers are raised after each layer has been rammed and care taken to see that no weak spots develop where the spacers have been. When the lining has been rammed to within a few inches of the top, it is finished off by adding water glass to the lining mixture to promote a low temperature hardening, or by using some special cement or "Compo." In small furnaces the top of the lining is frequently protected by placing a heavy iron ring on top of the steel template which is usually only about 3/16 in. thick and ramming lining material between this ring and the coil.

Scrap is then charged into the steel liner and the power turned on. At first the template becomes red hot, but there is comparatively little heating of the charge. After the lining has been soaked at say 2372 deg. F. for an hour or so, the liner splits by melting from top to bottom, more power can be employed, and the charge begins to heat up in the normal manner. The time required for an ordinary melt is of the order of 1 to 2 hr. for a two-ton furnace, or 1 hr. for a 1/4-ton furnace, but considerably longer is allowed for the first melt in a new lining.

Materials:

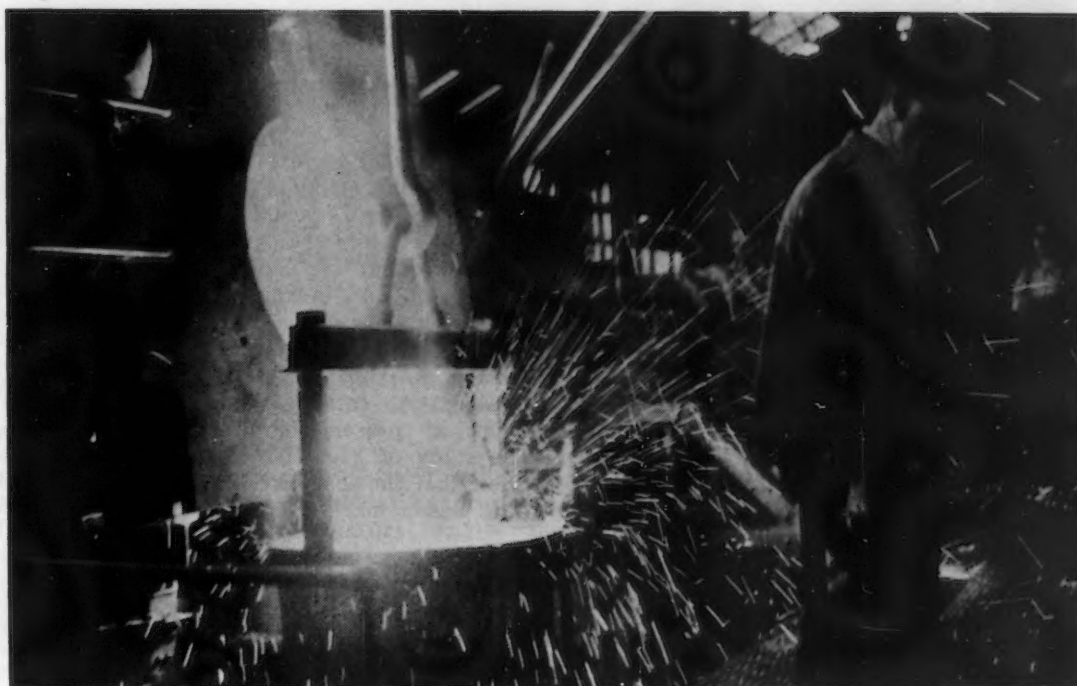
In the early days a basic lining, magnesite, in a 1/4-ton furnace only lasted a few casts, after which it cracked and the metal got through to the coil. Some linings did not even survive the first cast, the sintering tendency of the lining material being insufficient to give a hard monolithic surface after one cast and the lining material falling in as the liner slid down into the melt.

Years of study of the behavior of induction furnace linings led to the conclusion that by far the most important controllable factor was the grading of the material. Thus, if the lining was too coarse it did not sinter, but, on the other hand, if it was too fine it was difficult to ram and generally showed a high firing shrinkage. It was finally decided that the following provided a safe though not necessarily ideal grading for all induction furnace lining materials:

B.S.I. Sieves	Equivalent Tyler Sieve	Amount, Per Cent
7 to 25	8 to 28	45
25 to 72	28 to 65	10
72 to 150	65 to 150	20
Through 150	Through 150	25

Gradings of this 45-10-45 type have a moderately high packing density; sinter quite well, 25 per cent of "through 150 mesh" material being adequate; have a fairly low permeability; do not float when rammed as do linings containing, say, 35 per cent of "through 150 mesh" material; and do not show

TAPPING a five-ton induction furnace.



any serious tendency to segregate, such as occurs when a considerable proportion of "on 7 mesh" material is present. Further improvement has been obtained by the use of coarser magnesite linings, but where such linings do give success it is essential that they be standardized since quite small variations may result in serious difficulties.

A series of gradings on a successful basic lining material is given in Table I. This represents samples taken from consecutive deliveries and shows that the variation can be kept within quite close limits. It will be seen that the fine fraction is less than that given in the above specification while the intermediate and coarse fractions are greater. The change to this type of grading was found to give better results with large furnaces, probably because of the decrease in firing shrinkage and specific surface associated with the increased coarseness of the material. With linings of this type, particular attention must be paid to avoiding segregation, which may be serious both in the bags as supplied and in subsequent pouring and ramming. It is best to mix all the material required for a lining before putting any of it into the furnace, and to watch carefully to see that serious segregation does not occur as a result of the rebound of the coarser particles on impact with the coil, or vibration during ramming. The risk of such segregation can be readily demonstrated by putting a

small quantity of material having a grading of this type in a box and bumping the box on a bench. It will be seen that the coarse fraction comes to the top or side of the box forming a pocket of highly porous material. If such a pocket occurs in a lining, excessive localized wear or metal penetration will occur.

Quite satisfactory basic linings can be made for small furnaces by using either straight magnesite or magnesite bonded with 1 per cent boric acid. For larger furnaces, lining material having special bond additions is required if excessive cracking and consequent metal penetration is to be avoided. Thus a lining that had given excellent service in two-ton furnaces over a period of years was found to have the following analysis:

Material	Amount, Per Cent
MgO	73.5
CaO	5.4
Al ₂ O ₃	2.4
Fe ₂ O ₃	7.1
SiO ₂	8.2

The remaining 3 per cent consisted of traces of impurities together with small amounts of various bonds added for specific purposes.

The magnesite used can be any of the well known materials, but equal parts of Austrian and Grecian magnesite have been found to give particularly good results. The one essential is that the magnesite shall be well dead-burned. The degree of firing can be judged with some success from the specific grav-

ity, which with Austrian material, 4 to 8 per cent Fe₂O₃, is generally 3.54 or over, and with Grecian magnesite should not be less than 3.50; or from the crystal size which should be at least 0.03 mm. in diameter with magnesite containing 4 per cent or more of iron oxide. The final test, however, is the firing shrinkage, which will be discussed in more detail.

It might be expected that far superior results would be obtained with electrically fused magnesia, which is generally very pure, over 92 per cent MgO, and consists of large crystals. In trials carried out in 1/4-ton furnaces, however, using the 45-10-45 type grading both with and without a boric acid bond, the life obtained was no better than that given by ordinary dead-burned magnesite, while the shrinkage cracking appeared to be worse than usual.

It is a well known ceramic fact that sintering occurs more readily with fine ground than with coarse ground material. Thus, with porcelain or fused alumina batches where the body must sinter to give an extremely low porosity, fine grinding is always employed. The importance of the fine fraction in promoting sintering of induction furnace linings was not appreciated fully until linings containing an abnormally low proportion of fines, 5 per cent through 120 mesh, were tried. The results were disastrous. One such lining installed in a brand new furnace fell in during

the first charge due to lack of sintering in the top section. The effect is particularly marked if a small charge is used, since the top then receives very little heat treatment before the liner slides down into the bath. A similar batch of material milled to the 45-10-20-25 type grading was entirely satisfactory.

Most of the basic linings in use today show sintering at quite low temperatures, say 1832 deg. F. This is due, in part, to the presence of sufficient fines but also to the added bonds, such as boric acid, which melt below red heat.

If there is any doubt as to whether a new batch or quality of material will sinter adequately in

ing of the magnesite shows itself by an increase in the firing shrinkage. For a long time it was thought that if this shrinkage could be kept at say less than 4 per cent, no trouble would be experienced even with large induction furnace linings. The work that has been done on this subject during the last year shows that this is only a partial truth, and that in reality the factors governing the cracking of large basic linings are much more complex.

Unfortunately the results obtained cannot at present be divulged. The study of Fig. 10 will suffice to show that the composition of the lining has a marked effect

about 1 lb., is then melted and a suitable slag, such as mill scale is added. After a given time the furnace is shut off, the cast poured, and the pot removed and sectioned. A comparison of the cut, which is usually worst at the slag line, with that obtained with the standard material enables an estimate to be made of the durability of the lining material. The method has also proved useful in determining whether special slags, containing such fluxes as fluorspar or soda, would have a serious effect, on induction furnace linings.

(2) Crucible-Slag Tests:

Crucibles similar to those used in the above test are molded, filled with slag and heated up in a gas-fired kiln. The disadvantage of this method is that the nature of the slags may be radically altered by the absence of metal, while the swirling action of the latter is not taken into account.

(3) Pill Tests:

This technique has already been described in some detail in an earlier article.[†]

[†] "Steel Plant Refractories," THE IRON AGE, Feb. 6 and 13, 1941.

Other Basic Refractories

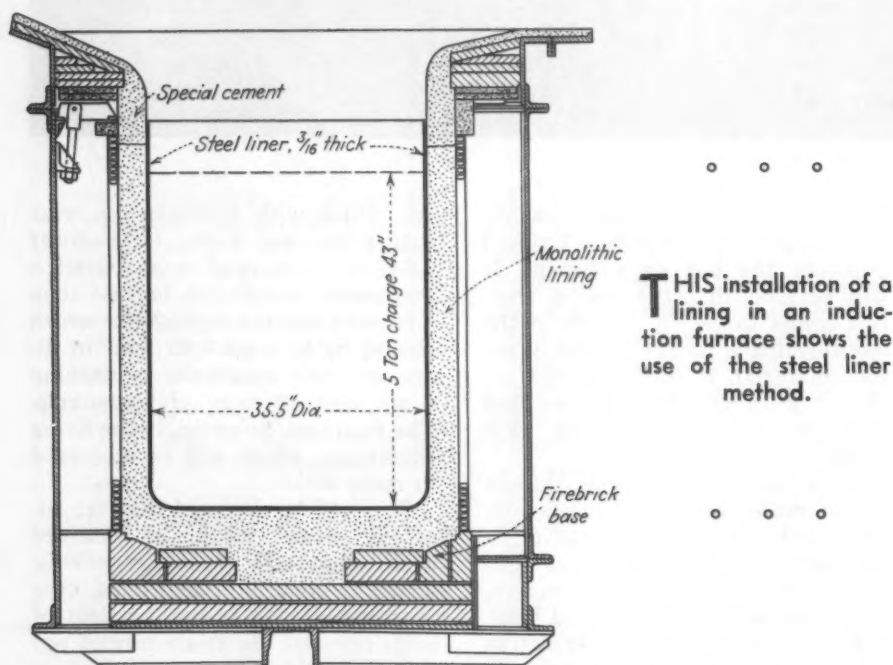
Chrome magnesite linings have been used both in brick and monolithic form. The results obtained were quite good, but since no improvement was obtained over magnesite and since there is the additional risk of chromium contamination, their use has not been pursued.

Linings have also been made from "basic" or dolomite calcined at a high temperature using 1 per cent boric acid as a bond. No difficulty was experienced in sintering the lining while the cracking was, if anything, less than normal but the life obtained was less than half that given by magnesite. The result is surprising since similar "basic" shows excellent durability in arc furnace hearths and sidewalls.

Several trials have also been made of 70-30 magnesia-zircon linings. This mixture has a positive expansion on firing and hence does not show the usual shrinkage cracking. Unfortunately, however, its slag resistance is markedly less than that of straight magnesite and hence its application in practice has been limited.

Neutral Refractories

Chrome linings have been tried in brick form, and with surprising results. Most of the brick dissolved



THIS installation of a lining in an induction furnace shows the use of the steel liner method.

practice, a comparison can be readily made with the standard by filling small crucibles with the two materials and heating them side by side to 1652 deg., 1832 deg. F., etc.

The most convenient method of measuring the firing shrinkage of a basic lining is to moisten 250 or 300 gm. of it and mold it into the form of a cylinder of 2 in. in diameter and about 2 in. in height by giving it 50 blows in an A.F.A. sand rammer. The test piece is then dried and fired for perhaps 1 hr. at 2912 deg. F. The height and the diameter of the test piece at the top and bottom are measured and the average linear shrinkage determined.

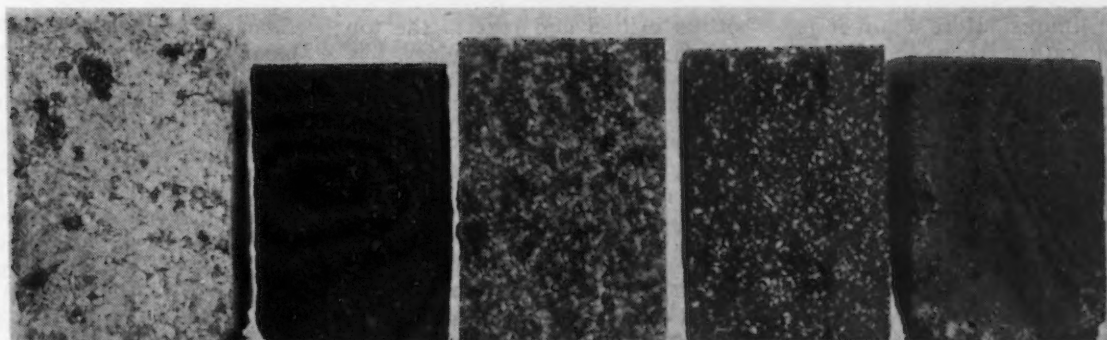
With successful linings the shrinkage is often as much as 8 per cent after this firing treatment. Any decrease in the degree of fir-

on the firing shrinkage. The tests shown were made on 3x2x2-in. test pieces and the length change was 3.9 per cent shrinkage for a basic lining and 11.3 per cent expansion for an acid lining. Intermediate values were obtained for various magnesia-alumina mixtures due to the expansion accompanying the formation of spinel or $MgO \cdot Al_2O_3$.

Three methods have been used for studying the slag resistance of acid and basic refractories of the type used in induction furnace linings:

(1) Baby Induction Furnace Tests:

Crucibles made from the lining material and either prefired 2 hr. at 2732 deg. F., or used green are placed in a small spark-gap furnace coil and separated from it by similar lining material. Bar iron,



EXPANSION and contractions of various lining materials after firing for one hr., at 2912 deg. F. Left to right, acid lining, basic lining and the 30-70, 50-50, and 70-30 magnesia-alumina linings.

in the steel during the first cast, as shown by the disappearance of the bricks and the chromium pick-up in the metal.

Zircon shows marked possibilities since it does not shrink when fired, is highly refractory and resistant to slags high in iron oxide. The difficulty with its use lies in finding a suitable bond, such materials as fireclay being readily attacked and the undissolved zircon grains floating out into the melt.

Spinel linings, made by mixing magnesia and alumina, have had some success. Thus 60-40 magnesia-alumina mixtures have been used in four-ton furnaces in the United States. A mixture corresponding to Spinel, $MgO \cdot Al_2O_3$, is approximately a 30-70 mixture and it will be seen from Table II and Fig. 11 and that this shows the highest firing expansion of all the batches tested. The expansion is due to the fact that the specific gravity of spinel is considerably less than the average specific gravity of its constituent materials, but the expansion is doubtlessly increased by the forcing apart of the reacting grains due to the formation of spinel at the interface, an effect that shows itself in increasing porosity.

It is doubtful whether such a high firing expansion is required to keep the lining of even a five-ton furnace steel-tight and since linings higher in magnesia are also higher in slag resistance the use of a 50-50, rather than a 30-70, magnesia-alumina mixture may be desirable.

Unfortunately, as with the magnesia-zircon series, both price and the lower slag resistance stand in the way of any extensive application of this type of lining.

Most of the acid induction furnace lining material used in Great Britain consists of ganister or

quartzite bonded with boric acid. In continental Europe, use is made of the natural clay-bonded sands known under the general title of Klebsand.

Where ganister or quartzite are employed they may be pre-calcined or used raw. The amount of boric acid or borax added as a bond varies somewhat but is usually about 1 per cent.

Typical gradings of acid lining material are given in Table III and Fig. 12. The table shows the risk of a bag to bag variation due to segregation prior to bagging. It will be seen that the standard grading with this material is a 52-8-40 type, and that, as with the original specification the distribution between the "72 to 150 mesh" and "through 150 mesh" sections is about equal. There is, however, a considerable proportion, up to 14 per cent of "on 7 mesh" material and it is largely this which segregates. In order to avoid segregation of acid linings during ramming and to reduce the risk of silicosis, 1 per cent of water is added to the batch. It had been suggested

that the water would have a disastrous effect on the coil insulation but no such result has in fact been observed, although the procedure has now been employed for about seven years.

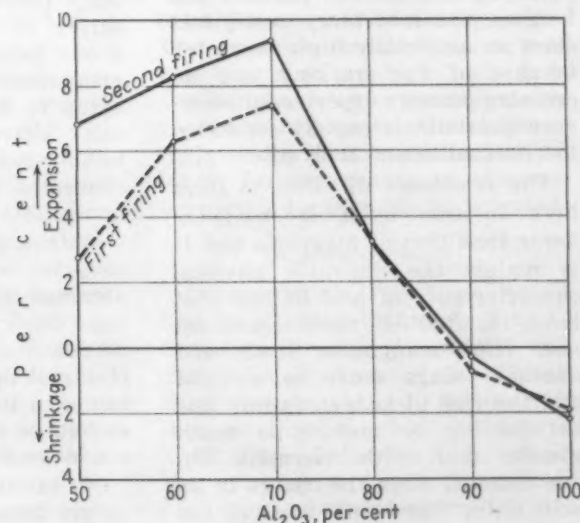
The following analyses, in per cent, serve to show the difference in the ganister and Klebsand type linings:

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	Borax	Loss on Ignition
Ganister lining	96.8	0.50	0.4	0.2	1.4	0.5
Klebsand lining	87.4	8.6	0.2	0.3	nil	2.9

The Klebsand material would probably have a much lower permeability than the ganister lining, but it is doubtful whether this would compensate for the reduced refractoriness and slag resistance caused by the presence of such a large percentage of alumina.

For certain methods of installing acid linings, it is essential that the material should sinter readily even at 1832 deg. F. The sintering tendency of a new lining can be compared with the standard by the method already described

LINEAR expansion and shrinkage of magnesia-alumina mixtures after firing for 1 and 2 hr. at 2912 deg. F.



for basic linings. Here again it is the bond rather than the lining proper that gives the low temperature strength.

In the early days of induction furnace linings, it was thought that the use of raw quartzites would result in excessive firing expansion and consequent damage to the coil. Ground silica bricks were, therefore, used instead. Some of the ganister used today is lightly calcined, or additions of silica bricks are made to it, but in either

bottom melted and rose to the top as a large pool of silica glass.

Life and Causes of Failure:

Typical lives of basic linings melting alloy steels are as follows: $\frac{1}{4}$ -ton furnace with basic lining = 85 casts; 2-ton furnace with basic lining = 55 casts.

Acid linings give a similar life if used on normal qualities of steel.

The basic lining lives correspond in both cases to a consumption of

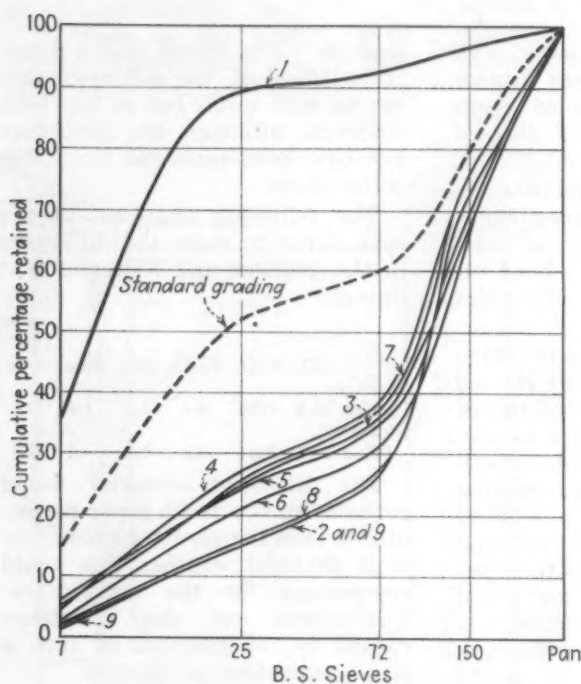
furnaces though many trial runs have been made. The outstanding difficulty is that after a limited number of casts, the lining cracks and the metal strikes through to the coil.

Acid linings, however, give good service in five-ton furnaces and the life obtained can be considerably extended by patching the lining with a mixture of ganister and china clay. With basic linings, water glass is often added to the lining material when the latter is used for patching work. Indeed so useful is this material, in spite of the effect it must have on the refractoriness that it is known colloquially as the "steelmakers' friend."

In general, linings wear out because of a combination of erosion and corrosion, which usually tends to be localized at the slag line. The rate of wear would undoubtedly be greater if it were not for the steep temperature gradient, which causes the fluxes to freeze as they penetrate. Incidentally this temperature gradient is beautifully illustrated with acid linings by the silica changes, the outer face being cristobalite, the next layer tridymite and the inside unchanged quartz.

The penetration of metal towards the coil is indicated on some furnaces by a special electrical "tell-tale." When this shows danger the lining is torn out rather than risk a strike to the coil. This "tell-tale," which is often arranged to work a "cut-out" when the leakage between coil and batch exceeds a safe value, is so sensitive it has to be put out of action during the burning in of a damp lining.

Abnormal failure of linings may be caused by insufficient sinter because of too little fines or bond, while localized wear may occur due to segregation or non-refractory inclusions. It should be mentioned in this connection that too much care cannot be paid to the conditions under which induction furnace linings are produced. Metal bolts, washers, or other non-refractory inclusions have been found in lining material. These might have resulted in a short between coil and bath and a serious explosion due to the entrance of water into the steel, had they not been discovered before the lining was installed. Finally, with acid linings in particular, the charge must be so worked as to avoid "bridging," that is, welding of the charge together, since this



VARIATION in grading of commercial types of acid induction furnace linings, showing segregation of the materials during bagging.

case the firing expansion is still high, namely in the order of 10 per cent for a test-piece fired at 2912 deg. F. for 1 hr. In actual practice the expansion is probably much less because some of it goes inwards, resulting in decreased porosity and because the laboratory test-pieces show an artificially high expansion because of the cracking and increasing porosity experienced whenever quartzite is rapidly converted to cristobalite and tridymite.

The resistance of silica to slags high in iron oxide is markedly lower than that of magnesia and it is mainly the desirable physical characteristics of acid linings that have resulted in their continued use. High manganese steels and fluorspar slags must be avoided and the risk of sudden failure due to slagging or melting is much greater than with magnesia. On one occasion when the charge in an acid lining "bridged," most of the

about 12 lb. of lining per ton of steel made.

The actual life will clearly vary with the steels made, the shut-down time, the extent of patching and even the order in which the various casts follow one another. Thus, a series of melts on low carbon steels, followed by a series of high manganese steels, is much less damaging to the lining than the same casts alternated. Why this should be so is not clear, but it is no doubt connected with the movement of manganese in and out of the lining.

With a good lining and an easy program, well over 100 heats can be obtained with a $\frac{1}{4}$ -ton furnace-lining. Such a lining will normally be removed at the week-end. Hence if a real improvement is to be obtained, a lining that will last twice as long is required since otherwise a mid-week shut-down would occur.

No satisfactory basic lining has as yet been developed for five-ton

leads to superheating of the shallow bath below.

There are many ways in which the induction furnace linings require improvement. Among the fields needing study are the following: (1) The development of a basic lining suitable for 5-ton furnaces. The use of such an improved lining in smaller furnaces would provide a much greater margin of safety than exists at present. (2) A reduction in the segregation of coarse and fine material during installation. (3) A new and improved type of joint between the lining top and the working lining. (4) More durable cements for acid and basic furnace patching, and more economical methods of applying them.

Brick Linings

As early as 1931, trials were made of brick linings in $\frac{1}{4}$ -ton coreless induction furnaces. The results obtained were good but the great care required to insure perfect joints has stood in the way of further development. More recently, however, trials have been made using machine pressed tiles and it is quite possible that such linings will ultimately be a recognized alternative to the monolithic type, particularly for large furnaces.

In the first trials, the linings were built of six rings of six bricks, each curved to the furnace contour and fitted with tongue and groove joints on both the vertical and horizontal edges, as shown in Fig. 13. A layer of grain magnesite was placed on the furnace bottom and the first course bedded in this, more magnesia being rammed between the coil and the brick to keep the latter in position. In these early trials the bricks were about $1\frac{1}{2}$ in. thick and the space between the coil and the brick was $\frac{1}{2}$ in. With larger furnaces, this space can be greater without resorting to the use of an inconveniently thin tile. This is desirable since it is difficult to be sure with a $\frac{1}{2}$ -in. gap that no cavities are left in the ramming material. Great care must be taken to see that the first course is concentric with the coil, since otherwise the lining will lean towards the side as it is built up, and any attempt to overcome this tendency may lead to open joints. The bricks can be set with wet or dry finely ground cement, but there can be no certainty that all the joints are perfect, and hence the powder packing must be relied on for steel-tightness.

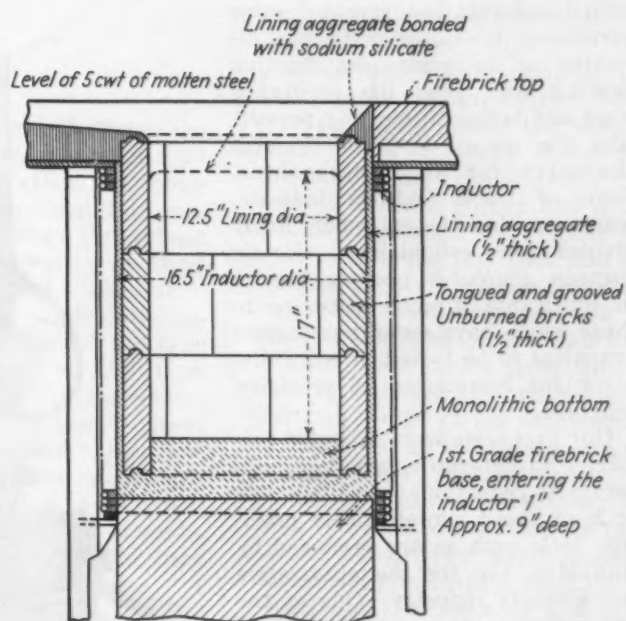
Some recent installations have been made with curved tiles about 10 in. high, set four to a ring, while several trials have been made with complete rings. Most of the tests have been made with unfired brick, but fired bricks have also been employed.

The early trials were carried out with brick made from magnesite or silica brick batch. Thus, the first set of brick was made from Grecian magnesite mixed with gum to give green strength, but otherwise free from bond additions. This lining was used in a $\frac{1}{4}$ -ton

chrome-magnesite brick showed little, if any, wear. The chromium pick up in the metal bath corresponded quite closely with that lost from the lining.

All the linings described were made from hand-molded brick. More recently, trials have been made of unfired curved tile pressed mechanically. The results obtained are said to be very superior, a life about twice that obtained with monolithic linings being claimed. Special spinel composition cements have been used both in the joints and for backing purposes, and the

SHOWN here is the method for installing brick linings in a $\frac{1}{4}$ -ton induction furnace.



furnace and did 115 casts before removal. Of these casts, 86 were of high manganese-high nickel quality, 14 plain carbon, nine stainless and six miscellaneous. At the time of the test, an all-time record at this plant was set, and even today the record life is only about 130 melts.

An acid lining made from unfired silica brick batch of normal steelplant grading did 74 melts of which 35 were high speed steel, 33 medium carbon, four stainless and two miscellaneous.

One $\frac{1}{4}$ -ton lining was constructed of magnesite, 50-50 chrome-magnesite and chrome brick set in staggered formation with two of each per ring. The result of this trial was most surprising. After a few melts of rusty bar iron, practically all the chrome brick had disappeared, forming a staircase up the inside of the lining, while the magnesite and

risk of a break through resulting from the fracture of a tongue during installation has been greatly reduced by the high pressure molding and correct bonding of the material.

It remains to be seen whether brick linings will become popular. They possess certain obvious advantages such as high bulk density but the risk of a break through a joint is considerable, and hence their use is likely to be confined to larger furnaces where an adequate monolithic backing can be provided.

Acknowledgment

In conclusion the author would like to express thanks to Dr. T. Swinden (director of research) and Mr. S. A. Jackson of the United Steel Companies, Ltd., for permission to publish this article, to F. T. Bagnall for his criticism of the manuscript, and to various

Graphite As a Lubricant For H

AN extensive series of test on high speed precision tools covering the effect of admixture of "dag" colloidal graphite with lubricants has revealed some surprising possibilities in the direction of increasing antifriction bearing and gear life, reducing wear and temperature, and permitting the use of lower mechanical clearances for such mechanisms. Some of these findings indicate, moreover, that the extremely finely divided and colloidalized electric furnace graphites produce results in lubricants directly opposite to those which have sometimes caused graphites to be looked on with disfavor for lubrication of precision bearings.

Our first tests were intended primarily to determine whether temperature reductions were possible in high speed, closely fitted precision tools such as are produced by Hall Mfg. Co. for the automotive and aircraft industry. One of the first experiments was on a standard multiple spindle gear box used to drive production type, multiple valve seat grinding equipment. From a $\frac{3}{4}$ -hp., 10,000 r.p.m. motor two spindles are driven at 9000 r.p.m. through swinging idler gears. Addition of colloidal graphite to the grease reduced the temperature rise above ambient from 60 deg. F. to 45 deg. in an hour's time, reduced current input from 7 to 6 amp. in a few minutes and stopped frothing of the lubricant immediately.

A second test was made on one of our style AW grinder heads, an especially compact unit for facing aircraft engine valve seats, Fig. 1. A $\frac{1}{4}$ hp. motor drives the grinder at a speed range of 10,000 to 15,000 r.p.m. It is small enough in size to fit inside the cylinder barrel and is difficult to keep cool on prolonged runs without auxiliary cooling means. In fact, with conventional lubricants, it was found that under continuous duty the temperature created by internal friction was too

high to permit manual handling of the tool. On test, after the gears had been accurately fitted and lapped, the addition of Oildag to

the gearbox reduced the temperature rise by one-third.

Experimental tests on equipment fitted with oversize hardened gears to determine whether the graphited lubricant would be effective under unusually severe conditions indicated that the normal rapid wear under such conditions was slowed up to the point where the gears remained oversize indefinitely.

The fourth test was made to show the effect of such lubricants on preloaded bearings. A special 10,000 r.p.m. spindle similar to the style AW spindle in assembly was given a 10-lb. axial thrust preload on the radial type bearings that supported it, causing the bearing temperature to rise 60 deg. Adding colloidal graphite to the grease enabled the bearings to carry the same preload with one-third less temperature rise. Tests with other loadings gave proportionate differences of temperature rise for the two types of lubrication.

Furthermore, tests indicated repeatedly that the admixture of colloidal graphite to greases not only reduced the ball and race wear, but also appeared to cause the grease to stay in the bearing three to five times longer under high speed conditions. In one typical test, carried on with an assembly of an EJ grinder shaft in which the bearing outer races turned at a speed of 11,000 r.p.m., the upper ball bearing was lubricated first with the best available plain grease, while the lower bearing had an Oildag addition to the lubricant. The upper bearing soon ran dry, while the lower did not. After thoroughly cleaning the bearings, the upper one was then lubricated with the colloidal graphite grease, while the lower was filled with plain grease. The lower bearing then ran dry. In fact, it ran dry four times before it became necessary to renew the grease in the upper bearing.

According to the bearing manufacturer to whom the bearings were later submitted for examina-

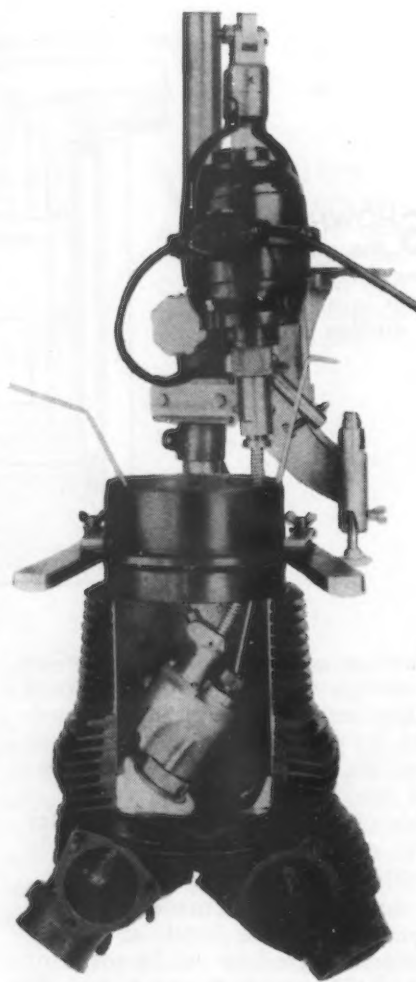


FIG. 1—This compact little high speed power tool finishes aircraft engine valve seats to a ten thousandth in 4 to 5 min. Because of its compactness and high speed (10,000 and 15,000 r.p.m. motor speed), the problem of lubrication is a difficult one. Use of a special grease containing Oildag colloidal graphite has reduced the operating temperature and lengthened the life of the tool on production work.

or High Speed Tool Drives . . .

tion, preloaded ball bearings which had been run for 300 hr. with the outer races turning at 12,000 r.p.m. (about 2.5×10^6 revs.) showed "no indication of wear or detrimental effects due to operating the bearings with Oildag and grease."

To avoid waste of time and material, all samples of special lubricants, greases and colloidal graphite were submitted to preliminary tests for abrasive action. Equipment used consisted of small soft steel blocks, ground flat, and provided with a definitely grained surface by stroking in one direction only with No. 400-A paper. A drop or two of the sample was placed between the surfaces, assembled with the grain lines parallel. Rubbing the blocks together across the grain with a light pressure for just a few strokes will not only give the drag of any abrasive but will produce visible scratches. (Grit too fine to be detected by conventional tests will show up under this test.) No trace of any abrasive action was found in the colloidal graphite lubricant.

Life Tests

As the result of the promising indications of these tests, it was decided to run an accelerated wear test on a typical high speed grinder assembly, to determine whether the reduction in wear found to hold true for anti-friction bearings would also hold true for the gears, when Oildag was added to the lubricant.

For this purpose one of our model EJ grinders was used, Fig. 2. This grinder, a standard unit in service work among passenger car and truck manufacturers, consists of a high speed electric motor (18,000 r.p.m. idling speed), driving a grinding spindle at 12,000 r.p.m. through gear reductions. The spindle has a slow speed eccentric motion so that grinding may be done by "point to point" contact.

At the speeds involved, the pinion and spindle drive gear approximate 500,000 tooth contacts per min.

By R. C. NEWBURY

Test Engineer, Hall Mfg. Co., Toledo

The intermediate gear between the two has double this number. To prevent noisy operation it is obviously necessary to maintain extremely low clearances throughout the assembly, thereby presenting lubrication difficulties. The lubrication problem is particularly severe in a non-stop test of the type conducted, in view of the high values of the centrifugal forces tending to throw lubricant out of gears and bearings and prevent re-establishment of proper lubrication.

While service life of these grinders with conventional lubricants, when properly serviced, had been

quite satisfactory as indicated by their widespread usage, the normal "life" of these units under high speed accelerated wear tests had been up to this time averaging only around 50 hr.

After assembly the grinder was first given a running check for general condition, using the conventional grease lubricant. It was then cleaned out and refilled with a mixture of Acheson Oildag and a test sample of grease. The grinder was then put on the test rack and run continuously, except for occasional stops for inspection, for 500 hr. Small quantities of the lubricant mixture were added from time to time to maintain the original level, offsetting evaporation and leakage.

At the end of the 500-hr. run the mixture was replaced with the plain test grease. The grinder was then returned to the test rack for a second 500-hr. run, again stopping occasionally to inspect the unit for wear, etc. In checking gears for wear, measurements over gage wires for the last half of the run were taken at the same marked points as at the end of the first 500 hr., instead of averaging random readings. The results are shown in the table.

From the table, it is apparent that the mixture of oildag with the test grease gave excellent wear performance for the first 500 hr., there being no measurable wear. The effect of the graphite, moreover, lasted a further 150 to 200 hr. after replacement with plain grease. This was apparently due to the formation of a graphoid surface on the gears and bearings, not only providing a certain amount of dry lubrication, but also effective in retaining more of the lubricant in contact with the surfaces, due to its greater wetting properties.

Subsequent performance of the test grease—without Oildag—was unsatisfactory, although satisfactory performance was re-established when the graphite grease was again



FIG. 2—This portable valve seat finishing tool (Model EJ), shown on its diamond dressing stand, was used for the life test reported in the table. Accelerated wear life of this unit was raised from 50 to well over 650 hr. (equivalent to 10 to 20 years of service life) by the addition of colloidal graphite to the lubricant.

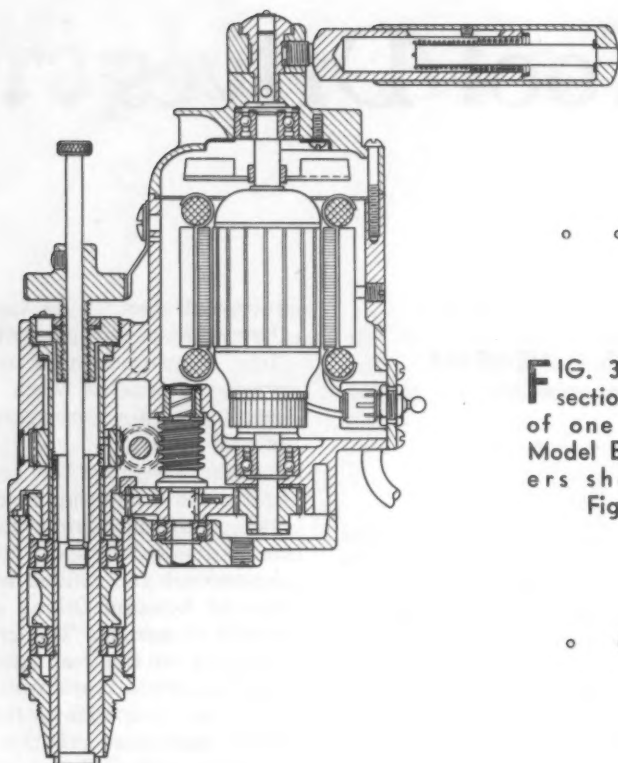


FIG. 3—Cross-sectional view of one of the Model EJ grinders shown in Fig. 2.

supplied and no further wear took place in the second 1000 hr. run.

Conclusions

These findings are in direct contradiction to the general feeling as to graphited lubricants, particularly in the lubrication of precision anti-friction bearings. However, it is believed that graphite's disfavor heretofore had been based on attempts to use natural graphite with its normally fairly high abrasive content or graphite in flake form. Graphite of insufficiently minute particle size or un-colloidalized, when used in anti-friction bearings, will form lumps which will indent

the races when the balls pass over them.

These characteristics apparently do not hold true for colloidal graphite, as produced by Acheson Colloids Corp. This material is extremely finely divided and does not indicate any tendencies to cake. As the result of its high affinity for oils, etc., as well as metal surfaces, it makes possible retention of grease in bearings under conditions where un-graphited greases are quickly thrown out.

These conclusions are based not on a single run but on an extensive series of tests under widely varying conditions with excellent correla-

tion of test results. When Oildag colloidal graphite is admixed, the tests would seem to indicate the possibility of relaxing somewhat the rigid lubricant specifications found necessary heretofore for the successful operation of high speed, precision tools, bearings and gears.

Steel Mill Illumination

FOLLOWING extensive investigations on iron and steel mill illumination, results of the findings of the lamp division of Westinghouse Electric & Mfg. Co., Bloomfield, N. J., were tabulated for various manufacturing operations. Table I, listing the data, is based on the scientific fact that existing foot-candle levels should be at least doubled if measurable, and significant improvements in seeing are likely to result.

In addition, the new recommendations give full weight to the improvements in old light sources, the high efficiencies of the new, and the downward trend of lighting costs as a result of such improvements. The values shown should be provided on the work regardless of whether in a horizontal, vertical, or oblique plane.

TABLE I

Suggested Illumination for Various Steel Mill Operations, Based on Investigations by The Westinghouse Electric & Mfg. Co.

Activity	Foot Candles
Steel and iron manufacturing:	
Billet, blooming, sheet bar, skelp, and slabbing mills	10
Boiler room, power house, foundry, and furnace rooms	10
Hot sheet and hot strip mills	10
Cold strip, pipe, rail, rod, tube, universal plate, and wire drawing	10
Merchant and sheared plate mills	20
Tin plate mills—	
Hot strip rolling and tinning machine department	10
Cold strip rolling	20
Inspection—	
Black plate, bloom and billet chipping	30
Repair shops—	
Rough bench and machine work	20
Medium bench and machine work	30
Fine work—buffing, polishing, etc.	100
Extra fine work	200
Blacksmith shop	10
Laboratories (chemical and physical)	
Carpenter and pattern shop	30
Storage	2

Gear Life Tests on Model EJ Grinder Unit

Lubricant	Hours Run, Cumulative	Gear Wear, In.	Sedimentation Wear Test
Oildag in grease	500	None	Minute trace of steel
Plain grease	600	None	None made
Plain grease	650	None	Trace of steel
Plain grease	700	1/30,000	Discoloration
Plain grease	800	0.00013	
Plain grease	920	0.0003	On intermediate gear
		0.00015	On spindle gear
Plain grease	1,000	0.0006	On intermediate gear
		0.0003	On spindle gear
Oildag in grease	2,000	No further wear.	

Lead and Tin Undercoats For Silver Plating

... Shortages of copper make it necessary to consider tin and lead as undercoats in silver plating. Methods and other considerations involved are discussed in this article.

By ADOLPH BREGMAN

Consulting Engineer, New York

AS this article is written, the effects of entrance into the war upon the electroplating industry are not yet clear. During the past year all of the metals commonly used in plating—nickel, chromium, cadmium, zinc and copper—have been made subject to priorities and regulations. Several of the more recent restrictions were Copper Conservation Order M-9-c, making copper as a plate unavailable for most decorative purposes, Order L-2-b prohibiting bright plating on automobiles, except for bumpers and a few other functional parts, Order M-43 applying to tin.

In recent articles by the author,* several possibilities were suggested and described, including methods of salvaging scrap anode metal, feeding plating baths with salts,

*"Priorities and the Plater," *THE IRON AGE*, May 15, 1941.

substituting other metals, and so on. But substitutes that were available three months ago are now under strict priority control; substitutes that are available today may go under similar control at any moment, and what is true today may be obsolete tomorrow. Nevertheless, it is only possible to proceed in accordance with the facts on hand at any given time, keeping in mind the possibility that some of the materials now

under strictest priority may be available, at least for some purpose, in the near future. For these reasons, the possibilities for electroplating, using materials that are at present available, will be discussed.

Because of present large supplies of silver at a relatively low price, the search for substitute plating materials has led to the serious consideration and actual adoption of silver plating for many purposes never heretofore even considered. In recent articles,† the possibilities for silver plating instead of nickel and chromium were discussed and the methods detailed.

These methods were based on the use of substantial undercoats of copper to provide corrosion resistance and to reduce the required amount of the comparatively expensive silver. However, the advent of copper Conservation Order M-9-c has cast a new light on the subject. At first it was thought that copper plating would be eliminated by the ban on decorative plating, but later interpretations have somewhat clarified the order.

†"Silver to Replace Nickel and Chrome Plate," *THE IRON AGE*, Nov. 13 and 20, 1941; Jan. 8 and 15, 1942.

The use of copper as a plate is permissible if its purpose is primarily protective. If used as an undercoat, as in copper-silver plating on steel,

its application is not at all decorative, as it is hidden from view by the top coat of silver. Hence its use in such fashion is permissible, subject to the other regulations and restrictions of M-9-c, amended Dec. 10, 1941.

Nevertheless, the highly fluid state of the metal situation makes it advisable to continue to look further for substitute metals and methods. The possibilities available, at least theoretically, at this time, include: (1) The electrodeposition of silver directly upon steel without an undercoat, (2) the use of tin, if available, as an undercoat, and (3) the use of lead as an undercoat.

The advantages and disadvantages of these possibilities and the techniques by which they may be carried out will be discussed.

The first and most obvious objection to plating silver directly on steel is the high cost of the plating material. The cost of nickel to a thickness of 0.0002 in., is about $\frac{1}{2}c$. per sq. ft., but the cost of silver in the same thickness would be 5.5c. per sq. ft. Clearly this differential cannot be overlooked. In the case of nickel, the cost of metal can be absorbed in the general item called "supplies" while, in the case of silver, special provision must be made for the cost of the metal.

However, the electroplating situ-

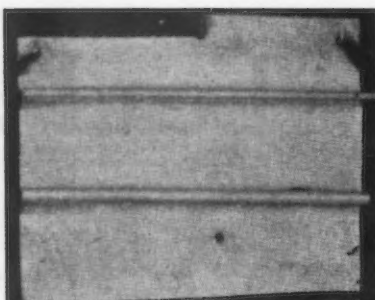
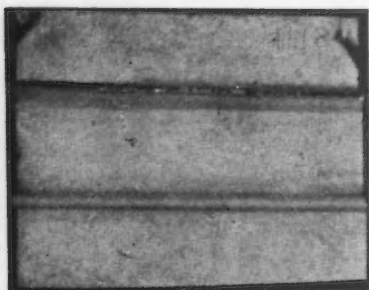


FIG. 1—Porosity of electrodeposited tin coatings, 0.001 in. thick, after bending, hot water tested. Freedom from porosity should be especially noted. (From *Electrodeposition of Tin from Acid Sulphate Solutions*, by Hothersall and Bradshaw.)

ation is in such a state that it is no longer a question of cost, plus or minus 50 per cent. Now, it is only a question of what to do in order to be at all able to turn out a marketable product and stay in business. Hence, the serious consideration of silver, even in substantial thicknesses, applied directly on steel.

Recent evidence on this problem consists of the work done by Mathers and Gilbertson.[‡] Their problem was to provide a heavy deposit of silver for bearing purposes without the copper undercoat. Copper, although it might simplify the bonding problem, would introduce some contamination of the silver if diffusion of copper occurred at the elevated temperatures encountered in bearing service in aviation engines. For that reason, plating directly on steel was employed.

[‡] "Adherence of Thick Silver on Steel," *Transactions of the Electrochemical Society*, 1938, Vol. 74, pp. 453 to 467.

It was noted by these workers that the forming properties of the silver, plated directly on steel, was satisfactory but that adhesion was variable and sometimes poor. Forming is of course, a very severe test, involving the stamping, drawing, etc., of preplated stock. It may be safely stated that for typical electroplating work, involving deposits on parts already formed, satisfactory adherence can be obtained. Briefly, the methods recommended were:

- (1) For mild steel, vapor degreasing or alkaline degreasing.
- (2) Dip for 15 sec., in 10 per cent hydrochloric or sulphuric acid at 192 deg. F.
- (3) Silver strike, care being taken not to allow the cleaned steel surface to become dry at any time after the acid dip and before the final plate.

The strike solution recommended was:

	Oz. Per Gal.
Silver cyanide	1/4
Potassium cyanide	2.40
Potassium carbonate	0.43
Current density	90 to 180 amp. per sq. ft.
Temperature	68 to 86 deg. F.

This amount of potassium cyanide was recommended by these workers, but common practice involves the use of a higher KCN content, up to 8 or 9 oz. per gal.

(4) Plating to the required thickness in the following solution:

	Oz. Per Gal.
Silver cyanide	3.5
Potassium cyanide	6.2
Potassium carbonate	5.0
Current density	3.7 amp. per sq. ft.
Temperature	68 to 86 deg. F.

Gentle agitation is recommended as well as frequent filtration. Coats as heavy as 0.05 in., were built up without intermediate buffing. The

low current density and careful filtration were found to reduce nodular and irregular deposits even in the heavy thicknesses. Stratification was reduced to a minimum by continuing the complete plating operation without interruption.

Adherence was obtained by following these precautions: (1) The prevention or complete removal of oxide films on the work, which might form during brief exposure to the air or by the action of alkaline cleaners, (2) the complete removal of grease, (3) sufficient pickling for etching, and (4) special care to have the work connected to the current source before immersion in the strike.

Another strike (silver-copper) commonly used in American practice for plating silver directly on steel, consists of:††

	Oz. Per Gal.
Silver cyanide	1/4
Copper carbonate	
$\text{Cu}(\text{OH})_2 \cdot \text{Cu}(\text{CO}_3)$	2
Potassium cyanide	9

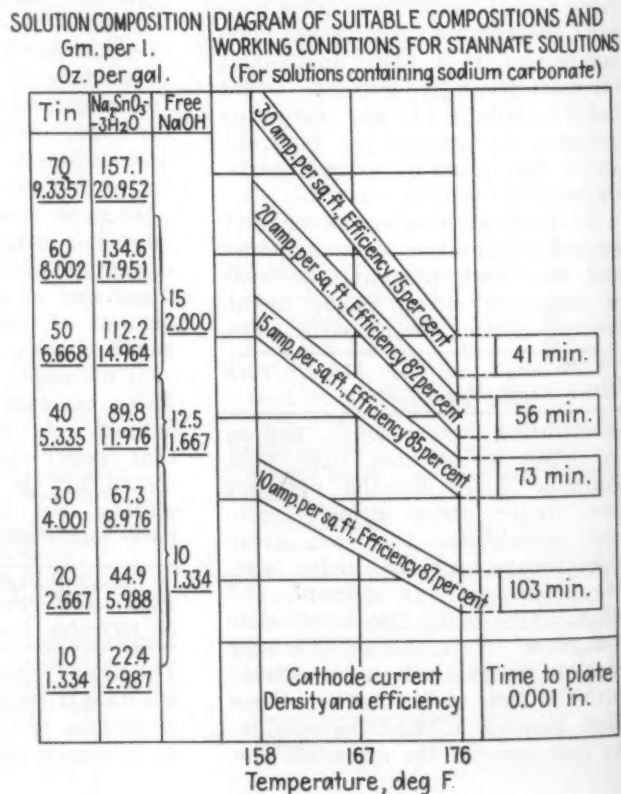
Still another strike recommended for plating directly on steel contains:**

	Troy Oz. Per Gal.
Silver	0.1 to 0.2
Free sodium cyanide	8 to 20

†† "Principles of Electroplating and Electroforming," by Blum and Hogaboam.

** "Silver Plating," by Promisel and Wood. A paper presented at the 80th general meeting of the Electrochemical Society in Chicago, Oct. 1 to 4, 1941.

FIG. 2 — Conditions of operation for the alkaline tin bath. (From *Electro-tinning*, by S. Baier.)



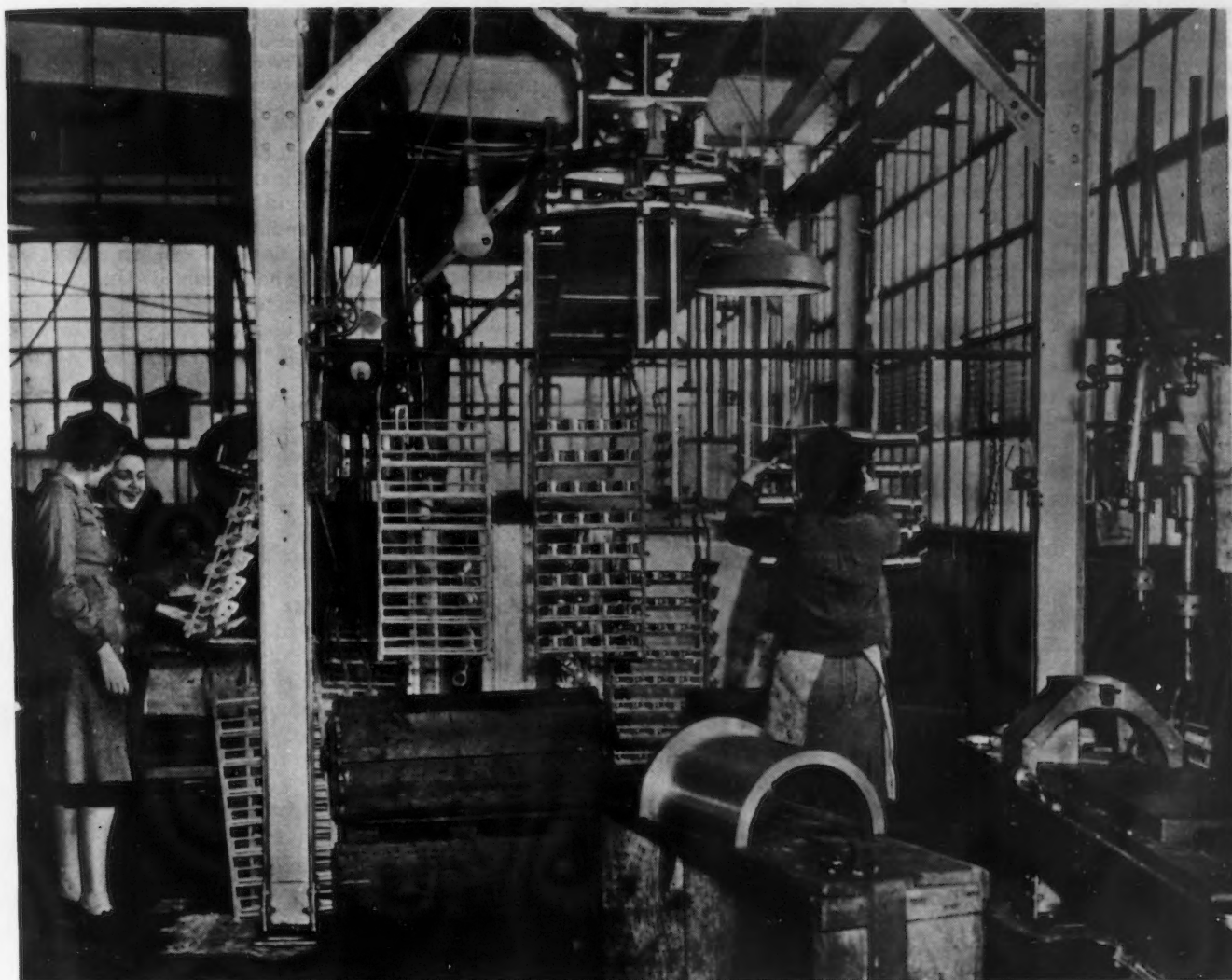


FIG. 3—High production tin plating on steel bearing-backs in a fully automatic conveyor. One girl is loading the racks with material to be plated, operator is loading the conveyor with the racks, and two girls are unloading plated bearings from the racks. Courtesy, Hanson-Van Winkle-Munning Co.

Tin is now being used as a substitute for nickel and chromium on a variety of products. Its corrosion resistance is known to be excellent, and, in thicknesses around 0.0003 to 0.0005 in., would make an excellent undercoat for silver, as shown in Fig. 1.

Tin may be plated from a variety of baths, both acid and alkaline. The processes have been well worked out and have proved satisfactory in many different kinds of work. A handsome finish of almost any thickness can be obtained. While the finish is rather soft, and yields fairly readily to abrasion, this softness is not a disadvantage when the deposit is used as an undercoat for silver plating.

Perhaps the most conspicuous disadvantage of tin plating is the high cost of power in comparison with silver. In practical operation,

under normal anode and cathode efficiencies, it takes 187 amp. min. per sq. ft. to deposit 0.0001 in. of tin from an alkaline solution, and only 38 amp. min. to deposit the same thickness of silver. Consequently, it is an open question whether it is worth inserting an undercoat of tin. Perhaps it would be better simply to deposit a heavy coat of silver, thus saving current, plating time, fuel, and labor involved in the various rinses and dips required when silver is to be plated upon tin.

Following are the tin baths in most general use today.

The stannate bath (alkaline) is probably in wider use for general work than any other at this time. It consists essentially of sodium stannate with a small excess of free caustic soda. This bath has excellent throwing power, gives a smooth adherent deposit and is easily controlled. The anode efficiency varies from 75 to 95, maintaining replenishment of the bath from the pure tin anodes at low, but not at high current densities.

FORTY-FOURTH in a Series of Articles on the Technical and Economic Aspects of Metal Cleaning and Finishing

Sodium acetate is added as a buffer and to aid anode corrosion. Hydrogen peroxide or sodium perborate may be used in small amounts to keep the tin in solution in the stannic or quadrivalent form. This is important, as the presence of stannous or divalent tin causes spongy deposits.

The tin may be kept in the quadrivalent form also by keeping the surface of the anode covered with a yellowish polarization film, maintained by holding down the free alkaline content of the solution. To obtain the proper yellowish film on the anode, from the beginning, the following procedure is advised.†† When beginning to plate, a very high current density should be applied for 1 or 2 min.; 1½ times or twice the regular normal current density. When the film has formed, which is visible, the current may be reduced to normal.

†† "Electroplating," by S. Baier. Publication No. 92 of the International Tin Research and Development Council.

When the bath has been idle and the anodes are out of the solution, before beginning operations, one method of obtaining the film is to hang the work in the tank first, then lower the anodes slowly into the solution with the normal current density switched on. The film spreads over the anodes as they are slowly lowered into the solution. Another, and easier, method is to put a few dummy anodes on the work rod and put in full current.

A recommended formula for the sodium stannate, alkaline bath, is:

	Oz. Per Gal.
Sodium stannate	9 to 16
Free caustic soda	1.5 to 2.5
Sodium acetate	2.5 to 5
Hydrogen peroxide or sodium perchlorate	1/16
Current density	10 to 25 amp. per sq. ft., generally about 15
Voltage	4 to 6
Temperature	about 165 to 170 deg. F.

The anode current efficiency is about twice the cathode current efficiency at low to moderate current densities. Therefore, the anode surface facing the cathodes need be only about one-half of the work area. The anode area depends upon the total amount in the tank. It must be adjusted to get the polarization film.

Excessive quantities of sodium carbonate, which will form during prolonged operation, should be removed by allowing the bath to cool to about 40 deg. F., causing the formation of large crystals of

$\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$, which can be removed with a tray of nickel or of iron gauze. The anodes must be removed to prevent the crystals from forming on them. Fig. 2 shows the various compositions and working conditions for stannate solutions, from which the optimum can be chosen.

Occasionally, organic acids have been added to obtain a deposit of better color. Some of these acids are: Lactic acid, 0.8 oz. per gal.; tin resinate, 1/32 oz. per gal., or resin, 1/32 oz. per gal. The resin forms sodium resinate or rosin soap, and keeps the spray down. These additional agents tend to reduce the cathode efficiency and may also cause patchy deposits if they are not thoroughly stirred into the bath.

If the bath is unavoidably idle, the anodes should be removed to prevent the polarization film from dissolving. If the idleness is of such short duration as to make this step impractical, false cathodes, such as sheets of pure tin or a few anodes may be used to provide a small load for the tank.

Foaming agents, such as sodium resinate or sodium oleate, may be used to create a small amount of foam on the top of the bath to prevent the spray from the cathode from contaminating the surrounding atmosphere.

The limitation of this bath is its low cathode efficiency, about 50 per cent, and its low anode efficiency at high current densities. Its resistance is at least twice that of the acid bath, calling for a voltage of 4.5 compared to 1.1 for the acid bath using the same anode to cathode distance and current density. The cost of power for the alkaline bath is several times that of the acid bath, and, under ordinary conditions, the acid bath will deposit tin two or three times as fast as the alkaline bath. Also the alkaline bath must be run hot, thus adding to its cost of operation. However, it is thoroughly practical and in wide use for high production work. Applications of the alkaline bath are shown in Figs. 3 and 4.

The Acid Tin Bath

The acid bath, generally stannous sulphate, has a high current efficiency, low operating temperature, and good stability. Its most promising use to date is for plating strip steel. A recommended formula is:††

	Oz. Per Gal.
Sulphuric acid	13.5
Tin (dissolved anodically)	4.8
Cresol sulphonic acid	16
Gelatin	0.333
Beta-naphthol	0.167

The solution is prepared by adding sulphuric acid and cresol sulphonic acid to water in the tank, about one-half full. Then, sufficient water is added to bring the solution to the required level. The cathodes are then placed in porous pots (cathodes may be steel or tin-plate) and the pots filled with dilute sulphuric acid of about a 10 per cent concentration. This dissolution is continued until about 4 oz. per gal. of tin have been dissolved. It may be necessary to filter the solution to prevent the absorption of the beta-naphthol addition by the precipitated tin compounds. Then, add the gelatin dissolved in hot water and stir the mixture. Finally, add very slowly the beta-naphthol, dissolved in a small quantity of alcohol, stirring constantly. If a precipitate again appears, the solution should be filtered or the precipitate allowed to settle before using.

The current density used is about 10 amp. per sq. ft. at about 68 deg. F. Anode and cathode efficiency are about 100 per cent, and at 10 amp., a coating of 0.001 in. can be deposited in about 50 min., with a voltage of from 0.6 to 0.9.

Anodes should be of pure cast tin. They should be bagged to prevent the small amount of metallic slime which may be produced from contaminating the bath and causing rough deposits. The best bagging material is glass but wool may also be used. Cotton is undesirable. The solution must be kept clear by periodic or continuous filtration. This bath has poor throwing power and cannot be used on work of complex shapes, with deep recesses.

Silver on Tin Plate

For silver plating on a tin deposit, it is necessary first to give the tin a light buffing or coloring operation with lime compound or crocus-lime compound to obtain a polish on the tin sufficiently high to produce as bright a silver deposit as possible. The polishing compound is cleaned and removed by a solvent to make unnecessary a long cleaning time in the alkaline cleaner. The work is then dipped in a mild cleaner, such as, for example,

$\frac{1}{2}$ oz. per gal., each of trisodium phosphate and soda ash, at about 175 deg. F. Direct current at 6 volts may be used if desired. The work is then rinsed, dipped in 10 per cent hydrochloric acid, or a cyanide dip of about 6 oz. per gal. concentration, rinsed again and then placed in the silver strike.

struck and then returned to the plating solution for the required plating time. The most important element in the cleaning of tin surfaces for subsequent plating is the care that must be exercised to avoid overcleaning.

The use of tin as an undercoat, advantageous as it may be in the

other more easily operable solutions. Also, the tin solution must be operated at fairly high temperatures, requiring heating facilities, live steam or immersion heaters which add to the cost of operation.

Lead Plating

The possibility of using lead as an undercoat is, strictly speaking, more theoretical than practical at this time. Lead is electrodeposited, but only to a limited extent because of the numerous disadvantages inherent in the presently known solutions. Its primary handicap, which comes before all other considerations, is the difficulty of obtaining adherence to steel. Various baths are available but all of them are difficult to operate or they give unreliable results. Some of the solutions that have been used to date are subsequently shown:

The lead fluosilicate solution is made up as follows:§

	Oz. Per Gal.
Lead fluosilicate	17
Fluosilicic acid	12
Glue	0.3
Goulac	0.3

Lead fluosilicate and fluosilicic acid may be obtained from lead refining companies, already combined in proportions ready for use. Plating from this bath requires a copper or brass undercoat which can, however, be very light.

The lead fluoborate bath can be used to plate lead directly on iron and steel without a copper strike.

	Oz. Per Gal.
Boric acid	14
Hydrofluoric acid, 48 per cent. . .	32
Basic lead carbonate	20
Glue	0.25

§ "Plating and Finishing Guidebook," 1941, p. 47.

The boric acid must be added to the hydrofluoric acid in a hard rubber or lead vessel, mixing slowly to avoid the generation of too much heat. After the mixture is cool, basic lead carbonate is slowly added while stirring. Avoid excessive foaming and take necessary precautions about the large volumes of evolved carbon dioxide. Filter or syphon to eliminate insoluble matter and dilute to the desired volume for electroplating. Glue is added and the solution may be used. Current density may be 10 to 20 amp. per sq. ft. at room temperature.

Mathers and Schwartzkopf§§ recommend a lead acetate solution for its possibilities, although it is still experimental. The components are commercially available and

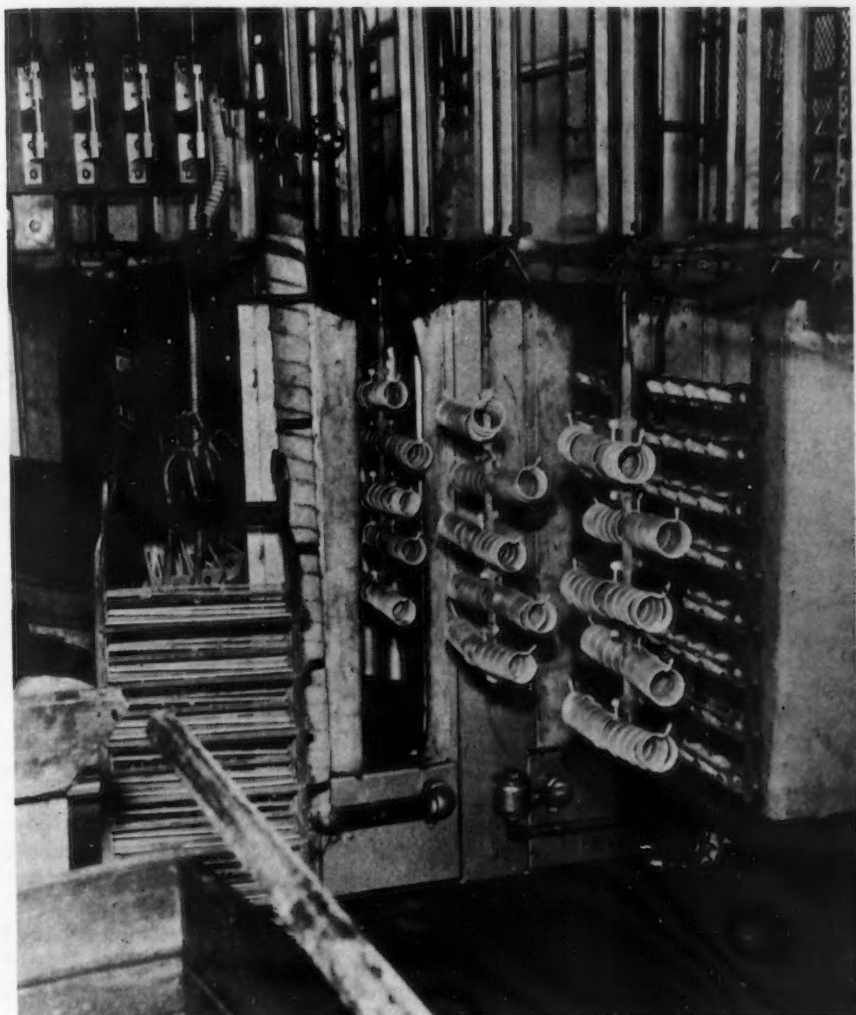


FIG. 4—Tin plated bearings emerging from the dryer. This tin plate is a spotless job, with no stains or surface mars. Courtesy, Hanson-Van Winkle-Munning Co.

From the silver strike, the work is transferred directly to the silver-plating solution without intermediate rinses, providing of course that the strike and the plating solution are both based on the same cyanide compound, sodium or potassium.

It is good operating practice to lift the work from the plating solution after about 10 min., rinse, and then wet scratch-brush to ascertain whether the deposit is lifting at any point. If such non-adherent spots are found, they can be cut through with pumice, the work re-

present emergency, brings with it certain problems of its own. It is well, therefore, to consider the following factors in planning such changes.

The first consideration, of course, is the fact that an additional installation must be made, involving in addition to the silver plating tank and silver strike tank, a tin plating installation. The tin solution must be operated under close chemical and analytical control. It cannot be allowed to "drift" with occasional check-ups that suffice for

cheap and the bath is not corrosive to ceramic vessels. Disadvantages, however, include low conductivity which increases power costs, and somewhat brittle deposits.

	Oz. Per Gal.
Lead acetate	13.4
Sodium acetate	21.4
Bone glue or goulac	0.67
Cresol	2
Current density	11 amp. per sq. ft.

§§ F. C. Mathers and J. B. Schwartzkopf, *Proceedings American Electroplaters' Society*, 1940, p. 120.

A lead perchlorate bath is also recommended for experiment by Mathers and Schwartzkopf. It has the disadvantage of high cost, but is free from many of the disadvantages of fluoride baths. An alkaline lead bath, using lead acetate and sodium hydroxide, is also mentioned but deposits for this solution are said not to give as good protection to iron as from the acid solutions.

Lead has been deposited from acetate solutions, from 0.001 to 0.003 in. in thickness, with smooth, finely crystalline deposits. The adherence of the lead to the iron was variable but in some instances it

was unusually good and sufficiently adherent for soldering.

Silver on Lead

The deposition of silver on a lead deposit is not difficult. To prepare lead for subsequent silver plating, the treatment, in general, is similar to the preparation of tin plate. The lead deposit may be scratch-brushed wet to improve its lustre, then cleaned in a mild alkaline cleaner as with tin, then rinsed and dipped in a cyanide solution (4 oz. per gal.); then rinsed, placed in the silver strike and silver plated as with tin.

Conclusion

Throughout this series of articles on silver plating of consumer products, it has been the effort of the author to suggest ways and means of replacing the critical defense materials; copper, nickel and chromium, with non-critical available materials at the lowest cost.

Silver stands out as the one freely available metal. Its primary disadvantage—its high cost in com-

parison with the base metals—has led to the consideration of undercoats, of which copper was the first, to come to mind. Since the Copper Conservation Order M-9-c has forced consideration of other undercoats as well, it was natural to turn to tin and lead. Lead offers little encouragement from a practical standpoint because of the difficulties involved in the operation of its plating solutions. Tin also has its questionable aspects. In spite of our present large stocks of tin, conservation orders have already been issued. Moreover the labor and power required in its electrodeposition are high.

This leaves only one practical, available, commercial, out-of-the-experimental-stage material to use—silver. Silver is expensive, to be sure, but its net addition to the cost of the finished product is only a fraction of the proportion of the metal-to-metal increase in cost over other metals.

It is more than likely that today's crisis will teach the public that silver is a serviceable, as well as an ornamental metal.

Induction Brazing 75 mm. Shell Adapters

INSTALLATION of new electrical induction heating equipment for the brazing of adapters to 75 mm. chemical shells has resulted in an 833 per cent minimum speed-up in heating time in a Pittsburgh plant. One operator heats two shells simultaneously in 50 sec., whereas former methods required at least 5 min., if not more, for one shell. This remarkable speed-up in output is obtained on an electrical induction heating unit manufactured by the Ohio Crankshaft Co., Cleveland. Tocco process machines are silver soldering chemical shells 12 times faster and reducing rejections to one or two per 1000.

Shells are placed nose down in an inductor mounted on a small 20 kw. Tocco Junior utility unit operating on 120 amp. and 15 kv. The machine is equipped with a 9600-cycle motor generator set with a 220-volt hook-up. Automatic controls govern the brazing cycle to a split second, eliminating the danger of overheating. Two men perform the entire fluxing, adapter fit-

ting, soldering and handling operation. For surface hardening, these units are readily converted by merely mounting proper inductors to transformers and by establishing the hardening heating and quenching cycle.

An important feature of the induction brazing process is the control of the heat to within a 1/4-in. band on either side of the joint. Operators can handle shells bare handed without tongs. There is no prolonged cooling off period and uniformity marks the finished braze.

Adapters are threaded and screwed into the nose of the shell. In the past gases tended to leak at the joint. Now, induction brazing is reported to have completely sealed this union in satisfactory fashion. A ring-formed strip of silver solder is slipped over into the recess in the adapter; a thin layer of flux is brushed on, and the adapter is screwed down tightly by hand. The threaded joint is carefully cleaned with carbon tetra-

chloride before these operations and adapter flanges and nose face of shell are filed clean of any burrs or slight nicks. Grease or dirt must be avoided.

Each shell is tested under 100 lb. air pressure in a specially designed machine which incorporates a kerosene "bubble bath" to reveal leaks. Rejects average no more than two per 1000 shells traceable in the main to a dirty seal face or thread burr. Excess solder on the outer shell surface is turned off on an automatic lathe, and the adapter joint cannot be detected in the final shell.

Induction brazing is being used for additional defense purposes, such as, brazing collars to burster tubes and brazing aviation engine accessories, fuselage parts, tubes and flanges. It is serving in the manufacture of numerous other parts also, because of its high speed, uniformity of results, control of the heat, low operating costs and the use of unskilled labor.

By FRANK J. OLIVER
Technical Editor, *The Iron Age*

Titaniferous Adirondack Ores Being Reworked

UPSETTING of world markets and cutting off of imports of strategic raw materials, either directly by submarine activity or indirectly through the throttling effect of rising freight rates, is causing the reopening and working of domestic mineral resources, the existence of which have been long known but which have been neglected for many a reason, mostly economic. Falling within this category is the great Adirondack titaniferous iron ore deposit, in Essex County, N. Y., now being reopened after years of idleness. The history of these deposits, which were discovered over a hundred years ago, is a romantic tale of struggles against great odds and the sending of good money after bad in one attempt after another to catch the plum tantalizingly lying just beyond the reach of profitable commercial development. The odds included the severity of the climate, the remoteness of the spot and the problem of transportation through what is still a wilderness area, as well as technical difficulties encountered in the ore utilization.

The problem of transportation, which is the chief factor that defeated the pioneers remains to plague the present developers, the National Lead Co. But ironically enough, the titanium dioxide (TiO_2), which occurs as ilmenite ore, accounts for about 16 per cent of what is otherwise pure magnetite ore and which during the last 50 years was chiefly responsible for preventing the ore from going to market, is what the new owners are after. When the property was first worked, the methods of reducing the ore were so crude that it mattered little whether another element other than iron was present or not. Curiously, too, it was this same ore the study of which led to the discovery of the value of ti-

ONE of the largest deposits of iron ore east of the Lake Superior region, which except for some experimental operations has not been worked commercially since 1858, is now being opened up on a vast scale to exploit its high titanium content. The history of the once thriving iron smelting operations of the old McIntyre Iron Co. is recalled. War time restrictions on imports of ilmenite and the demand for titanium oxide pigments has spurred the development of this isolated property.

tanium dioxide as a pigment and also the development of ferro-carbon titanium as a deoxidizing and purifying element in the manufacture of steel.

Only a relatively small amount of ilmenite goes into ferro-carbon titanium. By far the greater portion of the world production of this mineral goes into titanium oxide pigments for paints and white rubber; also into paper, porcelain enamel frits, welding rod coatings, plastics and a host of other industrial applications. Right now, titanium oxide paint pigments are important because they release the more critical lead and zinc ores for other uses than pigment bases.

For several years, the chief source of domestic ilmenite ores was Florida, but these sands have not been worked since 1922. Since then most ilmenite has been imported, principally from India. Lesser quantities have come from deposits in Norway, Senegal and Brazil. In 1939, importations from all sources amounted to 255,846 gross tons. Even a year before "Pearl Harbor" these imports were practically cut off by submarine activity, lack of cargo space, rising freight rates and the fact that other imported raw materials like manganese, tin, rubber and tungsten were more critical and had first call on available cargo space. Hence, faced with the possibility of a complete shutdown for lack of ore, the Titanium Division of the National

Lead Co. in the spring of 1941 decided to purchase the titaniferous iron ore deposits of the McIntyre Iron Co., frequently referred to as the Sanford ores.

Lake Sanford is a stillwater section of the upper reaches of the Hudson River in the Town of Newcomb, Essex County, N. Y., in the heart of the Adirondack Mountains, about 50 miles west of Port Henry on Lake Champlain. The ore body outcropping on the west slope of Sanford Hill comprises one of the largest ore bodies east of the Lake Superior region—estimated at one time to contain up to 90,000,000 tons of a mixture of magnetite and ilmenite, including other nearby deposits under the same valley floor. Discovered in 1826, the site saw the gradual development of a crude but thriving bloomary forge furnace (wherein wrought iron is produced directly from the ore) and the later development of a sizeable blast furnace, for those days. Ill luck, floods, death of the original founders and the panic of 1857 put an end to the first venture and left the "deserted village" of Adirondac.

The property changed hands many times, but the heirs of the founders managed to hang on, and for a period of 25 years, from 1890 to 1914, explorations of the property were pursued and extensive tests made to prove that the iron ore could be worked in a modern blast furnace without any deleterious effect of the TiO_2 on the lining.

The evidence seems to be irrefutable on this score, yet after a series of false starts and hopeful negotiations with blast furnace operators, the owners finally gave up and settled down to operating the property as an exclusive game preserve and selling the timber rights to paper companies.

When the present operations are under way this summer, the magnetite concentrates will be stockpiled, but it is difficult to believe that in these times of greatly expanded steel and blast furnace output this valuable by-product material will be permitted to lie idle long. But before discussing the operations planned by the National Lead Co. it should be of interest to review the fascinating history of this wilderness area, which is just as primitive and remote today as it was almost 100 years ago.

Deposit Discovered In 1826

In 1826, Archibald McIntyre and Duncan McMartin, the former at one time state comptroller and the latter assemblyman and state senator, were interested in a small furnace at North Elba, just south of Lake Placid and not far from the spot where "John Brown's body lies amouldering in the grave." The ore used was of an inferior grade and came from a distance. Attention was called to the presence of ore in the wilderness further to the south by an Indian who suddenly popped up, although none had been seen around there for several years previous. A scouting party was organized and was guided by the Indian through the awesome Indian Pass down to Henderson Lake, named after David Henderson, one of the members of party and later son-in-law of McIntyre. One of the guiding spirits of the venture, Henderson was a prolific letter writer and the fact that several hundred of his letters were preserved has enabled much of the early history of this iron development to be traced. The party was greatly excited to find an outcrop of pure iron ore 30 to 40 ft. wide cutting directly across the outlet stream from the lake. Further investigation revealed deposits of ore all around the area to such an extent that the discoverers obtained the impression of an inexhaustible supply. This was not the Sanford deposit, but came to be known later as the Old Bed.

The following summer, a state

surveying party staked out an area of 6080 acres in Townships 47 and the Gore East of Township 47 in the old Totten & Crossfield Purchase. The state put a valuation of 10c an acre on these wild lands, then a trackless wilderness.

In fact, then as now, means of transportation was one of the first problems to be met. First, a road had to be built to Lake Champlain, the nearest point of civilization, 50 miles away. In 1828, Judge McMartin, then in the state senate, secured passage of an act appointing commissioners to explore and build a road from Lake Champlain into Lake Henderson. It was not until 1832 that a crude bloomery forge was constructed. A few years later, Henderson mentioned that the McIntyre Iron Co. was making only about 1500 lb. of iron a week, an insignificant amount considering the possibilities of the place.

Henderson Takes Charge

The first blast furnace and a puddling furnace were built in 1838, the year that Henderson was put in active charge of the works. The blast furnace must have been a small one indeed, because when a second one was built some six years later there was a question as to whether it should be made 14 or 20 ft. in height. But it was a step along the road toward the goal stated in the articles of incorporation of the Adirondac Iron & Steel Co., filed with the secretary of state in 1839, "for the purpose of making from ore in the Town of Newcomb, in the County of Essex, bar iron, anchors, mill irons, chains, steel sheet iron, nail rods, hoop iron, nails, spikes, bolts and iron mongry." The company was capitalized at \$1,000,000. In the same year, the first of the many railroad enterprises linked with these ore bodies was authorized by the state legislature in an act to incorporate the Adirondac Railroad Co. (wholly owned by the iron company) for the purpose of constructing a railroad from the iron works to a point near what is now Port Henry. Actually only 3 miles were constructed, mostly in the form of a wooden causeway over marshy ground.

This year was notable in another respect. Prof. Ebenezer Emmons, State geologist, had been making extensive explorations of the property and based on his findings the largest ore bed of all was opened

on Lake Sanford (Named for Major Reuben Sanford, head of the State survey party in 1827). Professor Emmons trenched the side of Sanford Hill and located the boundaries of an outcrop of almost pure ore 540 ft. wide by 1670 ft. long, with the edges disappearing beneath tabular masses of rock. The only foreign minerals he found present were earthy ones like hypersthene, labradorite, hornblende and common feldspar. Much of the ore has little country rock mixed with it.

Titanium First Mentioned

The first mention of titanium in connection with these McIntyre ores is in a letter written by Henderson to Archibald McIntyre in July, 1843, in which he stated: "Professor Johnson analyzed our ores and found that they contained from 16 to 18 per cent of titanium in the shape of an acid. (Recent tests show an average of 16 per cent titanitic acid, TiO_2 .—Ed.) Prof. John Murray of Edinburgh analyzed them and found only 7 per cent of titanium and manganese, which is of no account whatever. . . . Beck gives no titanium. What are we to believe . . . Mr. Steele says that what Johnson says is absolute nonsense—16 or 17 per cent titanium in it would totally prevent it from making iron at all."

At that time and in earlier correspondence, Henderson had recognized that there were two different forms of ore present, but he reasoned that the iron oxide was present in two forms, what he called a protoxide and a peroxide of iron. As a matter of fact, he was on the right track since the magnetic oxide of iron, Fe_3O_4 , is frequently expressed as $\text{Fe}_2\text{O}_3 \cdot \text{FeO}$. What he termed the peroxide of iron was non-magnetic—"extremely bright and glistening"—a perfect description of the mineral ilmenite, the peroxide of titanium associated with the simple oxide of iron, FeO .

The titanium report disturbed Henderson during the summer of 1843. He had been devouring all the available texts on chemistry and geology of the period, which were crude indeed by present standards of knowledge, and even set up a laboratory to carry on independent experiments. Reporting to McIntyre on some of the tests made by himself and John Steele, he wrote that they had "come to a hole in the ballad. We cannot separate the protoxide and peroxide as held

in solution as a precipitate of iron. . . . All the authorities on analysis throw no light on the subject." So the researchers were at a loss as to how to proceed. They did admit, however, that "as regards titanium, it is present in all three ores—viz.

mountains was great and the mine manager reports that much of the power of the 5000 magnets was lost due to their getting wet coming in, but the machine performed a satisfactory enough job, considering the abundance of ore to work on and

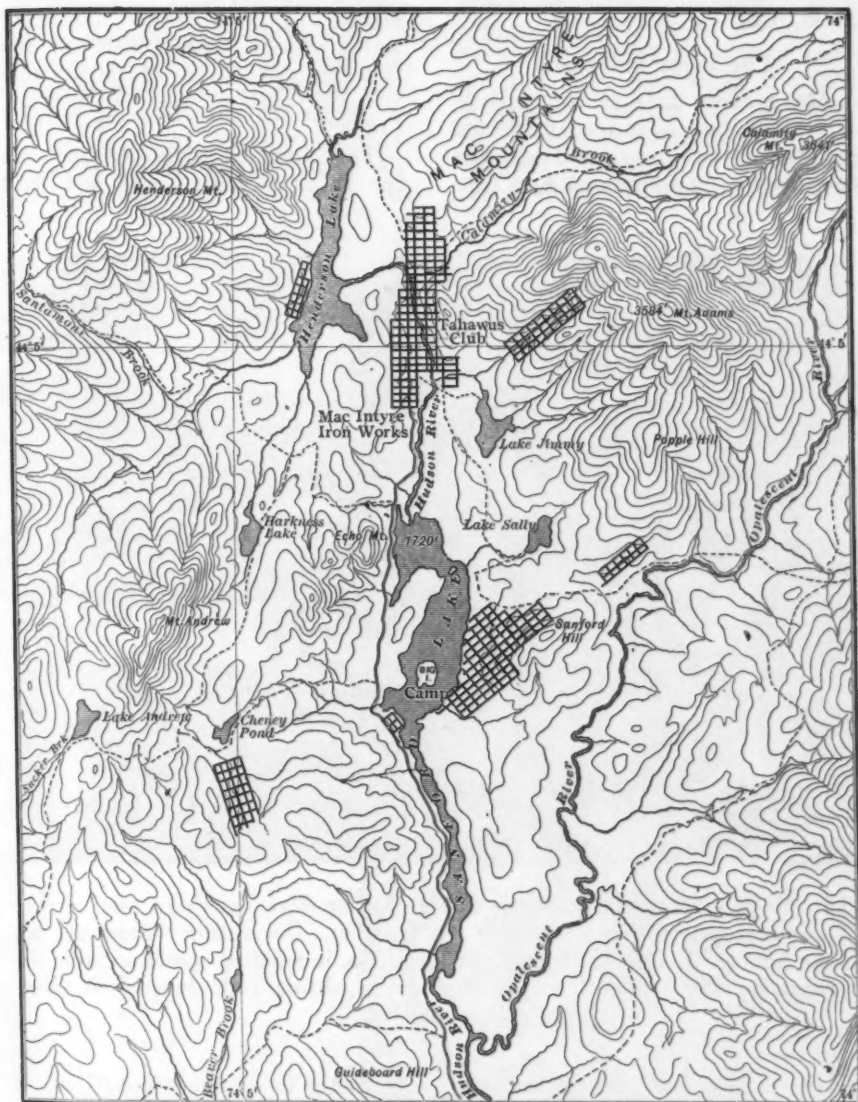
med up to form 10 miles of slack water over which the product of the works could be transported by barge, thus cutting down the distance of wagon haulage to Lake Champlain over what must have been terrible roads even in those days. There were some 16 dwellings erected at the Upper Works, a Church of Tubal Cain (first iron-master mentioned in the Bible—Genesis IV), and a private bank which held forth briefly.

But despite the activity, the operations were still not self-supporting. In 1843 Henderson figured he had sunk some \$36,000 in the venture by this time and McIntyre a great deal more. In a gloomy moment he confessed to the latter that "he was compelled to consider it lost." Nevertheless, he was back at the works the following year, sinking more of his wealth in the hills. In the winter he managed his real estate holdings in Jersey City.

Meanwhile a new blast furnace was being constructed. It was completed in June, 1844, and by October a record run of 2345 lb. of iron was made in one day. Henderson began to see gold in the bottom of the sock, commenting that "she must come to 300 cwt. gross and Adirondack will keep itself in operation bye and bye without further advances."

The next year, 1845 was a fateful one because there was lost to the venture the driving energy of David Henderson who accidentally shot himself while on an exploration trip into the mountains to see whether the Opalescent River, a branch of the Hudson, could be diverted down another valley so as to add to the water power available from Henderson Lake. A small monument, appropriately inscribed, marks the spot of the accident, several hours walk from the iron works over a mountain trail. The brook beside which the monument stands bears the name Calamity as does the mountain that forms its eastern flank.

The death of Henderson was a severe blow to the company. Judge McIntyre was then 73, McMartin had sold out his interest some years before and other directors were not familiar with the technical details of the iron business. But the drive and momentum of Henderson's ideas were to influence the company for many years. For example, Henderson had been experimenting with the manufacture of blister



MAP showing the old MacIntyre iron ore deposits in the Town of Newcomb, Essex County, N. Y. This map, reproduced from the Oct. 14, 1909, issue of *The Iron Age*, shows the areas that have been studied by magnetic surveys or diamond drilling. It is the large outcrop of ore on the westwest slope of Sanford Hill that is now being worked for its titanium content.

—the black, fine grained and Lake Sanford—but not in any quantity to do the last injury." . . . "How Johnson of Philadelphia could get 16 to 18 per cent is a mystery to us," Henderson concluded.

Meanwhile, Henderson set about procuring a second-hand magnetic separator. The hazard of getting this piece of equipment into the

the crude methods of metal refining employed.

Period of Greatest Activity

Between 1839 and 1845 was the period of the greatest activity of the old McIntyre Iron Co. During this time 300 to 400 persons were living at the site, including the Lower Works at Tahawus, where the Hudson River had been dam-

steel, made by packing wrought iron bars in between layers of charcoal and heating the charge for 10 or 12 days. He had obtained the loan of the foreman of the Sheffield Steel & Cutlery Works, but this Englishman held back all he might have presumably known about the business and discouraged the manufacture of steel at Adirondac, as the village was called. A few years after Henderson's death, however, as a result of these studies, the Adirondack Iron & Steel Co. was incorporated under the laws of New Jersey and a works erected in Jersey City.

Early Crucible Steel

For many years this company made what was called "cast steel" but what is now identified as crucible tool steel (1½ per cent carbon). Cemented or blister steel, named because of the bubbles of CO entrapped in the steel from the reaction of the carbon with the slag inclusions, was broken into bits and remelted in a small crucible, thereby floating off the bulk of the impurities. First made by Benjamin Huntsman, a watchmaker of Sheffield, in 1740, crucible steel manufacture was a closely held secret for over a century.

At Jersey City, an attempt to make crucible steel by melting the crude blister steel in crucibles made from local clay was a failure at first until the prolific inventor, Joseph Dixon, conceived the idea of mixing black-lead or graphite with the clay. The contribution was so noteworthy that the Joseph Dixon Crucible Co. survives to this day, whereas the Adirondack Iron & Steel Co. has long since faded into the forgotten past.

Of the excellent quality of the cast tool steel made at these works, there is plenty of evidence in the testimony of government officials and private consumers. Officials of the Washington Navy Yard, for example, in 1850 reported that "for the purpose of turning, chipping, drilling, etc., we consider it the equal, if not superior to the very best English cast steel we have used." Incidentally, this cast steel received a gold medal for its quality at the Great World's Fair in London in 1851.

James M. Swank, one of the early historians of the steel industry, wrote that although the product of this mill was not of uniform excellence. . . . "the exact truth appears to be that the cast steel pro-

duced by this company during the early years of trial from 1849 to 1853 was more uniformly excellent than that which had been produced by earlier contemporary American steel works, the Cincinnati steel works of Garrard Brothers alone excepted. This excellence was due to the superiority of the Adirondack iron."

Ore Lures Railroads

Along about this period, outside capitalists began to be interested in the great ore body and laid plans to exploit it on a large scale by con-

pleted in 1854. It measured 36 ft. square on the ground and was 48 ft. high, with an 11½ ft. bosh diameter. To heat the blast supplied by two sets of horizontal blowing tubs, two narrow brick stoves were placed on top of the furnace, which was charged from a bridge connecting with the hillside. Power was furnished by two large undershot water wheels. The capacity of this furnace was about 14 tons a day and the cost of its construction, \$43,000.

This furnace remained in blast for 18 months and was left with



In this wilderness valley of the upper Hudson River is where one of the largest deposits of iron ore in the East lies. The distant waters are of Lake Sanford beside which National Lead Co. is erecting a mill capable of processing 5500 tons of crude ore daily to obtain 1800 tons of ilmenite concentrates.

structing a railroad into the wilderness. When the Sackett's Harbor & Saratoga Railroad was formed, the object was to throw a line diagonally across the Adirondack plateau, with a short spur to the iron mines. Sackett's Harbor is on the eastern end of Lake Ontario. A survey party was put in the field in 1853 and a year later about 30 to 40 miles of the proposed road were graded, following the course of the Hudson River northwest from Saratoga.

Naturally, the proprietors of the iron works were appraised of all this activity and entertained reciprocal anticipations that their prosperity would be greatly increased. Work was started on a new blast furnace which was com-

its lining in excellent condition. It was never run thereafter, as we shall see, but stands today in the wilderness in a fair state of preservation (see photo).

Unfortunately, for lack of funds, work on the railroad project ceased after the initial grading. This was another crippling blow to the iron works, faced as it was with tremendous cartage rate (\$25 a ton) to Port Henry. A disastrous flood in the summer of 1856 destroyed much of the machinery and there was no incentive to replace it. The final blow came in 1858 when Archibald McIntyre died at the age of 81, followed a few months later by the death of his remaining active partner.

A year later, the village of Adi-

rondack was referred to by passing woods travelers as the "deserted village." Work had been stopped as it was. The last cast from the furnace was still in the sand and the tools were left standing against the wall just as at the end of a shift. The last corporate action of the McIntyre Iron Co. was to appoint James R. Thompson, a nephew of David Henderson and superintendent of the Jersey City works, as agent for the company.

The demise of the iron company, however, did not put an end to railroad activity connected with the

constructing a line from Troy or Saratoga Springs to the Adirondack Iron Works and thence to Sackett's Harbor. The directors of the new railroad company were made up of New York financiers, plus six London capitalists who advanced most of the cash needed to purchase land contracts. This typical British tie-up proved unfortunate, for the Londoners pulled out the next year when the Civil War began, fearing that no American project of this character could weather the storm. The land contracts were defaulted and the prop-

pectus issued by the company a few years later, this city was envisioned as a second Pittsburgh, with ore coming in from the Adirondacks and coal from Pennsylvania and Ohio via existing railroads. The prospectus, which would not have passed present SEC standards, estimated a yield of 14 per cent on an investment of \$10,000,000. By 1870, 60 miles of track had been constructed up the Hudson River valley to what is now North Creek. This was as far as this railroad ever got. The company went into receivership, changed its name, got in fresh capital and failed again. Years later it was absorbed into the Delaware & Hudson Co. as the Adirondack Division, and it is to this railhead that the concentrated ilmenite ore will be transported by the motor trucks of the National Lead Co. this year.

In the interim, the iron property was divorced from the railroad interests and returned to the heirs of the original founders of the McIntyre Iron Co. James Thompson had become trustee of the company in 1880 and upon his death in 1887, James McNaughton of Albany, a grandson of Archibald McIntyre, became the trustee. Meanwhile, some of the timber was being sold off the property and the heirs formed an exclusive hunting and fishing club, which since 1897 has been known as the Tahawus Club. In 1894, to simplify the complicated holdings of the various heirs, many of them minors, the company was reorganized as the *MacIntyre Iron Co.* (note change in spelling).

In this same year, an important amendment to the State Constitution was made that has had far reaching influence on commercial activity in the Adirondack Mountains ever since. Section 7 added to Article VII provided that any lands acquired by the State within the Forest Preserve were "to be preserved forever as wild forest land" and went on to state that not a stick nor stone should be removed therefrom. The object of the law was to halt stealing of timber on State land by fly-by-night lumber companies.

In 1897, the Forest Preserve Board filed a certificate of condemnation, taking much of the railroad land for the purpose of making them a part of the Adirondack Park. On the same day, but several hours later, the Adirondack

BLAST furnace erected at the McIntyre Iron Works in 1854. The condition of its lining, still well preserved after being idle for 86 years, testifies to the fact that the high titanium content of the ore had no bad effect upon its operation.



Adirondack works, although the rough valleys of the North Woods were to be strewn with many failures before motor trucks met the challenge of these unusual economic and natural hazards. The organizers of the defunct Sackett's Harbor line made another try to interest fresh capital under the title of Lake Ontario & Hudson River Railroad. Their efforts were of no avail, however, and the company was foreclosed in 1860. A month later, articles of association of the Adirondack Estate & Railroad Co. were filed with the idea of

erty landed back in the hands of the backers of the original Sackett's Harbor company.

In 1863, the introduction of new capital led to the organization of the Adirondack Co., another railroad enterprise, whose history is fairly well documented. This company acquired not only all the right of way of the old railway company, but also the entire McIntyre or old Adirondack Estate, including the mines, works, etc., then idle.

Sackett's Harbor was dropped as the northwestern terminus and Ogdensburg selected instead. In a

Railway Co. filed a counter claim covering the proposed route of its line to Ogdensburg. Litigation ensued and was eventually carried to the United States Supreme Court where the board was upheld. Today, the MacIntyre property is practically surrounded by State land and if the present owners wish to construct a railroad to North Creek, the proposition must be brought up for two readings before the State legislature and if accepted must then be submitted to a statewide referendum.

Dr. Rossi's Work

McNaughton took active steps to exploit the ore property. He engaged the services of a young French metallurgist, Dr. A. J. Rossi, who was then operating a blast furnace at Boonton, N. J., where titaniferous magnetite ores were being successfully smelted. About 1890 with Dr. Rossi and several friends, McNaughton organized a syndicate and erected a small blast furnace at Buffalo where titaniferous ores were smelted in various proportions with Lake Superior ores. Dr. Rossi secured patents on the process of smelting these titaniferous ores and also on the manufacture of various titanium alloys. One such product was ferroc carbon titanium. In fact, as a result of this research, the Titanium Alloy Mfg. Co. was formed in 1906 and a plant built at Niagara Falls, N. Y., for the production of ferro-carbon titanium for use in purifying and scavenging steel.

In further research on titanium, Dr. Rossi succeeded in separating an impure titanium oxide. He demonstrated the opacity of the material by mixing it with salad oil and thus discovered the possibilities of such a material as a white paint pigment. Thus the titaniferous ores of the MacIntyre Iron Co. provided the stimulus for the titanium pigment industry, which later was to become of such importance and which is now preparing to use these same ores as the principal source of ilmenite. Eventually, Dr. Rossi and an associate worked out a method of separating titanium dioxide from ilmenite and rutile, and several composite types of titanium pigments were developed by them.

As an outgrowth of their studies, the Titanium Pigment Co. was incorporated in 1916 and a factory built at Niagara Falls. The ilme-

nite came from titanium bearing sands in Florida. National Lead did not come into the picture until 1920, when it bought a substantial interest in the Titanium Pigment Co. In 1932, the company was bought outright and operated as a subsidiary company. In 1936, this activity became the Titanium division of the National Lead Co. Meanwhile, new plants were erected at St. Louis and Sayreville, N. J., near Perth Amboy. The Niagara Falls plant was eventually shut down and in 1937 was sold to the Titanium Alloy Mfg. Co. The Florida ores were not drawn on after 1922 and foreign ores then became the principal source of ilmenite.

However, let us return to the fortunes of the MacIntyre Iron Co. James McNaughton passed away in 1905, but prior to his death conveyed the control of the MacIntyre Iron Co. to Wallace T. Foote, Jr., of Port Henry, who became president of the company. His brother George C. Foote became general manager. Both were also interested in the Northern Iron Co. furnace and the nearby mines operated by Witherbee, Sherman & Co., now under lease to the Republic Steel Corp. George Foote is still active in these companies and up until the time of the dissolution of the MacIntyre Iron Co. in November, 1941, was its vice-president.

Under the Footes, the Sanford Hill bed was reopened and operated on an experimental scale. From diamond borings and magnetic surveys, an estimate of 88,000,000 tons of available ore was made. (Recent borings made by National Lead place the available Sanford ore at 15,000,000 tons above the level of Lake Sanford, with an unestimated tonnage below that level. The results of these tests were reported on extensively in the Oct. 14, 1909, issue of THE IRON AGE. Everything looked favorable to the marketing of the ore. Bethlehem Steel Co. was reported contemplating making a contract with the company and in 1907 made a test of about 1500 tons of Tahawus ores, but the deal was never put through.

About this time another railroad project was begun with the formation of the Champlain & Sanford Railroad, planned to connect Lake Sanford with Addison Junction, just above Ticonderoga. The line was never constructed although the franchise was maintained up until 1934 when it was allowed to

lapse. Much of the lands reverted to the State, but the rights of way are still owned by the trustees of the Champlain & Sanford Railroad, either in fee or are reserved for railroad purposes, should the railroad project be raised again.

Wallace Foote died in 1910 and interest lagged until 1914, when another fruitless attempt was made to convince blast furnace operators that these highly titaniferous ores could be run without difficulty. During that year, extensive tests of Sanford ores mixed with Mineville ores were run in The Northern Furnace at Port Henry. The results of the tests were reported in THE IRON AGE and also in a paper presented at the October, 1914, meeting of the American Iron & Steel Institute by Frank E. Bachman, general manager of the MacIntyre Iron Co. His company had leased the Northern furnace for seven months.

Furnace Tests in 1914

During these tests, the old difficulties of transportation in winter loomed up once more. The original plan was to transport the concentrated ore from the mine by steam tractors drawing sledges over the snow. The first setback was the failure of the concentrating equipment erected at Sanford Hill. The crude ore then was transported by sledge only as far as the State road, and there it lay until motor trucks could haul it out in the spring to the railroad. Fortunately, some years previously, several hundred tons of crude ore had been brought down to North Creek by wagon and this material permitted a test run to be made for about 12 days in February. Later the tests were resumed in June and continued through July. The crude Sanford ore was concentrated at the Witherbee-Sherman plant at Mineville.

The Sanford concentrates ran from 11.8 to 14.0 per cent TiO_2 and from 54.1 to 56.5 Fe, with 0.12 to 0.17 per cent S and only a trace of phosphorus. In the pig iron produced from one-eighth mixture of this ore with Mineville concentrates, the titanium content ran only about 0.5 per cent, and cast iron made from these pigs showed superior breaking strength. Steel made in the open hearth with this same MacIntyre iron showed not a trace of titanium.

Bachman's Conclusions

From these tests Bachman drew these conclusions: That titanifer-

ous concentrates are reduced in the furnace with no greater and probably with less expenditure of fuel than non-titaniferous magnetites. The weight of slag produced per ton of iron from an ore of this composition is slightly greater than that produced from the average magnetic concentrate containing 62 to 63 per cent Fe. The slags produced are of much greater fluidity than those produced when TiO_2 is not present. The operation of the furnace above the tuyere level is more uniform and there will be less tendency to hang and slip. The iron produced will contain less sulphur and its silicon content will

niques have been greatly advanced since the days the first wilderness road was stretched west from Lake Champlain, and modern heavy duty, pneumatic tired trucks will make the trip to railhead with less wear and tear on the roadbed. Electric power coming in over the mountains has solved the problem of water power, one of the things that held back the development of the earlier MacIntyre Iron Co. and by mischance led to the death of its guiding spirit, David Henderson.

National Lead Co. is developing the MacIntyre property on a large scale. Nearly 11,000 acres have been acquired from the MacIntyre

churn drills to break the deposits and electrically operated shovels and dippers to load the broken ore.

The crushing plant will have a jaw crusher, a standard cone crusher and a short-head crusher, with attendant screens and conveyors. In the wet mill will be four rod mills, 12 Crockett wet belt separators for separating the magnetite, 96 wet concentration tables for separation of the ilmenite and units for dewatering the concentrate. In addition, there will be a dry mill with a battery of steam coil dryers and 21 Wetherill dry magnetic separators.

From the shipping bins the concentrate will be transported to the railhead at North Creek, 32 miles away, by motor trucks over a new $8\frac{1}{4}$ mile road built out to the State highway, 28N, at Tahawus P. O. Storage facilities have been provided at North Creek to hold two days' output of the mill. Aside from building these facilities, National Lead Co.'s Titanium Division has had to excavate a reservoir on top of the hill to supply mill water pumped from Lake Sanford, also for drinking water for the mill and a village now consisting of 31 houses, a dormitory, mess hall and a general store.

The expenditure necessary to this development is estimated at over \$7,000,000 and the operation is being fully financed by the National Lead Co. out of earnings and surplus. By direction of OPM, the company offered to make its facilities available to any other titanium pigment producer. Thus far the Krebs Pigment & Chemical Division of E. I. du Pont de Nemours & Co. has been the only one to avail itself of this offer.

When ilmenite concentrate ores begin to flow from this mill to plants engaged in the manufacture of titanium pigments, it will mark the rounding cycle of events in which the MacIntyre deposits served first as the inspiration of an idea (that is, the use of titanium dioxide as a pigment) and then became the means of continuing the development of that idea. It will write a happy ending to a story wherein an impish impurity—titanium—at one time helped thwart the attempts to develop the iron ore deposits of the locality, but eventually became the metal of prime consideration while the previously important iron content of the ore has been relegated to the position of a by-product.



THIS February, 1942, scene shows the new mill buildings of National Lead Co. rising on the shore of Lake Sanford. From left to right: Boiler house, dry mill, screen house, and wet mill.

be lower by an amount equal to one-half the titanium content. There is likely to be a tendency to periodical "dirty hearth" conditions in the working of the ore, but they are readily stopped by the removal of titaniferous ore from the mixture for short periods.

The tests made by Bachman were not under ideal conditions. Previous to the furnace being taken over by the MacIntyre Iron Co., it had been hanging and slipping, refusing to carry a full burden. Actually, when titaniferous ores were introduced, the furnace stopped slipping and ran more smoothly than for several months previous.

Although these tests were quite encouraging, nothing matured from them commercially and the concentrating plant on the east shore of Lake Sanford was allowed to fall into decay.

National Lead Co. has several things in its favor. War time conditions and shortages of strategic materials have created a great demand for titanium; modern high powered magnetic concentrating equipment and related wet methods have simplified the problem of separation; road building tech-

Iron Co., Tahawus Purchase, Inc. (holding company for the old Tahawus Club) and the estate of Christine MacMartin Masten, a descendent of Duncan McMartin. However, exclusive of the site of the Lower Works or Tahawus P. O., and the 4000 acres of the MacIntyre holdings, the property has been leased back to the previous owners, now organized as the Upper Works Club, for use as a fish and game preserve.

To Process 5500 Tons a Day

The program of operation calls for the mining of 5500 gross tons of ore daily from which the mill being erected will produce 800 tons of ilmenite of about 48 per cent TiO_2 content. In addition, as a by-product there will be stock piled approximately 1800 tons per day of magnetite concentrates, containing about 89 per cent Fe_2O_3 , 10 per cent TiO_2 and 1 per cent Si. The crude ore contains about 16 per cent TiO_2 , based on assays of numerous diamond drillings. Since there is a huge outcrop measuring approximately 550 by 1700 ft. on the western slope of Sanford Hill, the mine will be of the open type, utilizing

Measuring Furnace

... An instrument for the continuous measurement of the quality of heat treating furnace atmospheres by a comparison of the weight of the furnace gas with that of air is described herein. The operation of this instrument on a number of the more popular types of atmospheres is discussed.

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RECENT advances in the technique of heat treating metals in controlled atmospheres have stressed the importance of automatic gas atmosphere analyzing equipment if the qualities of the treated metals are to be economically reproducible.

Automatic analyzing equipment to be effective must be rapid, accurate, capable of being operated by unskilled men and rugged enough to withstand ordinary shop use without loss of accuracy. It is also desirable that such equipment, be low in first cost as well as in upkeep and that it be adaptable for either stationary or portable use.

Since the goal sought in production heat treatment is maintenance of a constant analysis, it is obviously sound practice to measure directly the quality of the atmosphere. Theory has indicated, and experience has proved that, with proper equipment, the specific gravity of an atmosphere provides a direct, easily measured index of its composition.

The Ranarex analyzer, which is basically a device for measuring the specific gravity, was developed by the Permutit Co. to meet the fundamental requirements noted above. This instrument, shown in phantom in Fig. 1, represents a special development of the Ranarex CO₂ analyzer which has been in use for many years in boiler plants for controlling combustion.

That the specific gravity of an atmosphere is related to its composition will be evident from the following table of specific gravities

of the common atmosphere constituents:

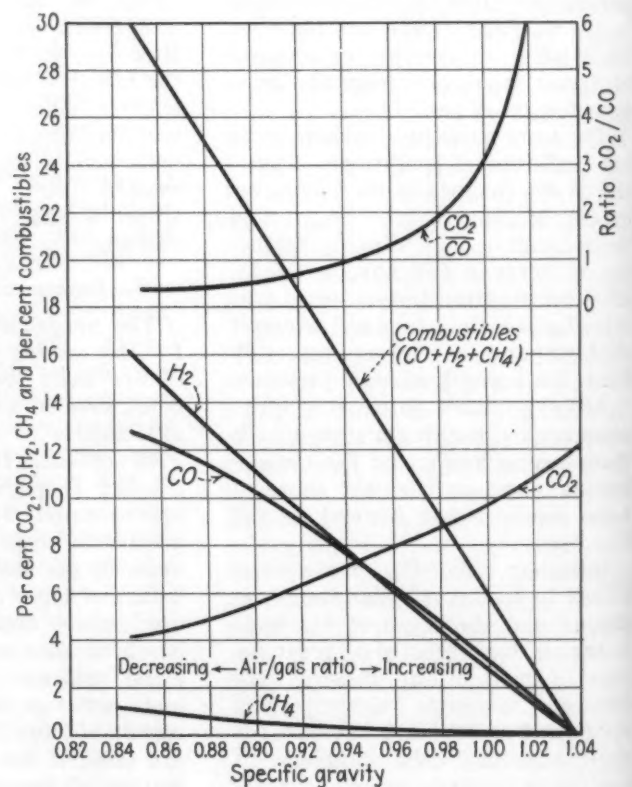
Constituents	Specific Gravity (Air = 1.000)
CO ₂	1.527
O ₂	1.105
N ₂	0.972
CO	0.967
CH ₄	0.553
H ₂	0.069
NH ₃	0.594

On the basis of the variance in the specific gravity of components of a furnace atmosphere, it is obvious that changes in the relative

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FIG. 2—Influence of changes in air-gas ratio on specific gravity of an atmosphere produced by incomplete combustion of West Virginia natural gas. The abscissae represent specific gravity (and the air-gas ratio) and the ordinates represent percentages of the various constituents.

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amounts of these constituents will affect the overall weight of the mixture. The manner in which the Ranarex atmosphere analyzer measures the specific gravity is shown in Fig. 1.

The lower impeller, B, continuously draws in a sample of the atmosphere to be analyzed. This sample is set in rotation and creates a torque on the companion impulse wheel, BB, which is located in the same chamber. These two fans are mounted on independent shafts and the method of creating the torque is somewhat similar to that employed in fluid drive transmissions in automobiles. The impeller, A, in the upper chamber continuously draws in a sample of ordinary air, which is rotated in a direction opposite to the gas sample and creates a torque on the impulse wheel, AA. The torque set up in the impulse wheel BB is proportional to the gas density and is compared with the

Atmospheres

By FRANKLIN B. LESLIE

Engineer, Permutit Co., New York

torque produced by air in the upper chamber.

The difference between these opposing torques, which is a measure of the specific gravity of the furnace gas, is transmitted through a sensitive linkage arrangement, C, to a pointer moving over the scale. The gas and air samples are brought to the same temperature and humidity by a built-in humidifier (not shown in Fig. 1) eliminating the possibility of error from these sources. A steel wool filter removes suspended matter and corrosive elements from the gas, should they be present.

Since the gases pass continuously through the instrument at a high rate of flow and since no time is required for chemical analysis, the instrument responds almost instantaneously. There are no pumps, aspirators, orifices, chemicals or sensitive electrical apparatus involved, hence a highly skilled instrument engineer is not required for successful operation and interpretation.

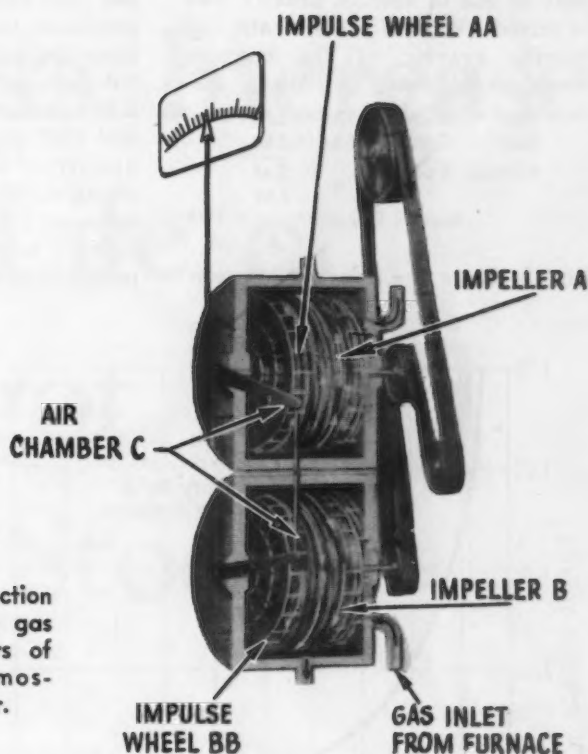
The operation of this instrument with some of the more common atmospheres is described below.

Partially Burned Gas

Partially burned fuel gas is the most easily made and cheapest atmosphere, produced by burning ordinary fuel gases in the furnace or a separate generator, with less air than is needed for complete combustion. The gas usually contains CO_2 , CO , H_2 , CH_4 , and N_2 , the proportions depending upon the temperature and other factors, but mostly upon the air to gas ratio.

When the air-gas ratio is large, the CO_2 becomes high and the CO , CH_4 and H_2 are low. This mixture is heavy because of the high CO_2 content and may be heavier than air. If the air-gas ratio is lowered, the CO_2 decreases and CO , CH_4 , and H_2 increase causing the mixture to become lighter.

FIG. 1—Construction details of the gas and air chambers of the Ranarex atmosphere analyzer.



These conditions are illustrated in Fig. 1, based on data obtained with a normalizing furnace fired directly with West Virginia natural gas. The abscissae represent specific gravity (and air-gas ratio); the ordinates represent percentages of the various constituents. This chart is shown for illustrative purposes and is not a requisite for the successful application of the Ranarex analyzer.

After a little experience, the operator will learn that the desired results are obtained with some specific instrument reading. The corresponding atmosphere may then be controlled, or at any time reproduced, merely by adjusting the air-gas ratio to give the same reading. This is possible because each analysis corresponds to one specific gravity only.

For various types of fuel, as natural gas, coke oven gas, butane, propane, etc., the character of this curve will change. For this reason Fig. 2 should not be used to predict results for any fuel but natural gas.

It has been shown that for atmospheres prepared from natural gas, coke-oven gas, and certain others, the sum of $\text{CO} + \text{H}_2 + \text{CH}_4$ (or

per cent combustibles), is proportional to specific gravity. When sufficient information is available, the instrument may be calibrated in terms of "per cent combustibles," otherwise in terms of specific gravity. Some instruments have been empirically calibrated on blank scales by their owners to measure a particularly desirable constituent.

In many cases it is advisable to remove the CO_2 from atmospheres produced by incomplete combustion. The action of the instrument in such cases is very similar to that for partially burned fuel gases. It should be noted, however, that the apparatus may be used to measure the quality of the initial generator gas and to indicate the completeness of the CO_2 removal by permitting it to operate alternately on both of these gases.

Premixed Air-Gas Mixtures

In some instances it is desirable to mix the gas and air before combustion. The air-gas ratio may be measured by measuring the specific gravity of the mixture before combustion. For example, if one

part of gas of specific gravity 0.64 is mixed with two parts of air, the specific gravity of the mixture would be calculated as follows:

$$\begin{array}{lcl} \text{Air:} & 2 \text{ parts} \times 1.00 & = 2.00 \\ \text{Gas:} & 1 \text{ part} \times 0.64 & = 0.64 \\ \text{Mixture:} & 3 \text{ parts} & = 2.64 \\ & & \hline & & 2.64 \\ \text{Specific Gravity} & = \frac{2.64}{3} & = 0.88 \end{array}$$

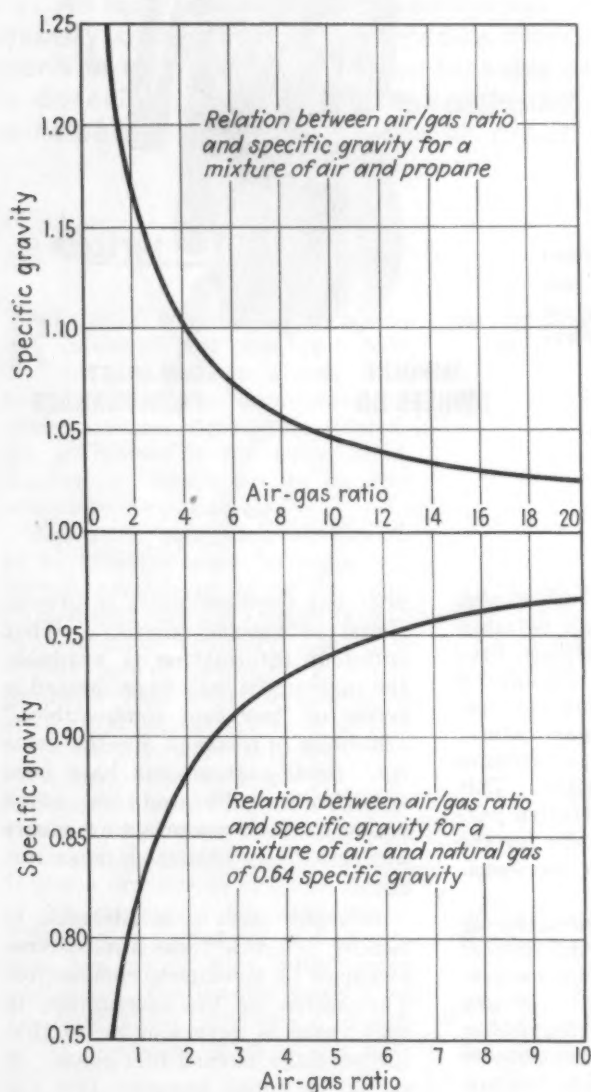
Fig. 3 shows the relation between

per cent CO and 66 per cent N₂ is produced but under actual conditions the analysis usually averages 3.0 per cent CO₂, 28.5 per cent CO, 3.25 per cent H₂, 0.25 per cent CH₄ and 65.0 per cent N₂. The specific gravity of this atmosphere will be about 0.957. If the charcoal bed becomes too thin above the combustion zone, or should the temperature fall too low, the CO₂ con-

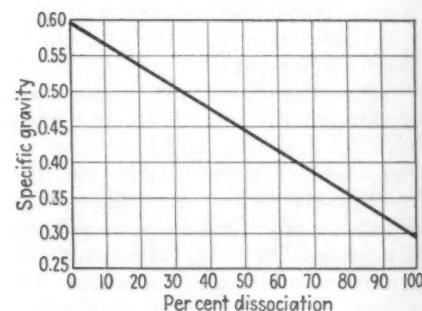
54.7 per cent and has a specific gravity of 0.866. This specific gravity is quite different from that of the untreated producer gas and immediately suggests the advisability of cross connecting the instrument to the producer for verifying the quality of the untreated gas and to the furnace for verifying the quality of the finished atmosphere after the addition the hydrocarbon and ammonia.

H₂-CO-N₂ Atmospheres

Atmospheres suitable for certain brazing operations may be prepared by cracking a hydrocarbon fuel gas in the presence of small amounts of air and steam. Mixtures as high as 35 per cent H₂ and 20 per cent CO are produced, and because of the high hydrogen content the specific gravity will be low, in some cases as low as 0.65. Various analyses are possible by appropriate operation of the system, or by converting the CO to



LEFT
FIG. 3—Relation between the air-gas ratio and specific gravity of mixtures of air with a gas of 0.64 specific gravity and with commercial propane.



RIGHT
FIG. 4—The effect of the degree of dissociation of ammonia on the specific gravity of the gas is illustrated above.

air-gas ratio and specific gravity for mixtures of air with a gas of 0.64 specific gravity and with commercial propane.

Dry Producer Gas

Dry producer gas is usually produced by passing air through a bed of relatively pure carbon at a sufficiently high temperature. Theoretically with dry air and pure carbon, an atmosphere of 34

tent will increase causing a rise in the specific gravity.

In some instances this type of atmosphere is treated by the addition of a hydrocarbon to increase the CH₄ content and addition of dry ammonia which cracks and increases the H₂ content, to render the gas less decarburizing. A typical analysis would be CO₂ 2.3 per cent, CO 29.5 per cent, H₂ 12.5 per cent, CH₄ 1 per cent and N₂

CO₂ and absorbing the CO₂ so formed. In any case, there will be a correct specific gravity for the atmosphere. If the proper specific gravity does not exist, the Ranarex analyzer will indicate this fact.

Cracked Ammonia

An atmosphere of 75 per cent H₂ and 25 per cent N₂ suitable for bright annealing stainless steel may be made by heating dry NH₃ to a high temperature. The specific gravity of the cracked gas is low (about 0.3). If complete cracking is not desired, the per cent dissociation may be measured from the specific gravity, as shown in Fig. 4. To produce a less costly atmosphere, completely cracked NH₃ is often burned with a deficiency of air to remove the H₂ as H₂O and dilute the gas with the N₂ of the air. Depending on the requirements, there will be a desirable specific gravity.

Inserts Increase Life of Ingot Mold Stools

By FRANK G. NORRIS
Wheeling Steel Corp.

AN ingot mold stool which, in actual service, has a service life substantially greater than previously used types of stools has been developed recently by Wheeling Steel Corp. Although improved types of big-end-up and bottom cast molds which do not require stools have been adopted for certain grades of steel, a large tonnage, particularly rimmed steel, is still poured in big-end-down molds set on cast iron stools. The advantage of cast iron for this service is that it does not warp and does not weld to the steel ingot.

The three chief causes of the scrapping of a stool are: (1) Major

cracking; (2) superficial cracking of the surface (also called fire cracking or crazing), and (3) gouging or cutting from the stream.

Major cracking is the chief cause of premature failure. It is reasonably certain that this type of crack is due to large stresses set up in the stool by the difference in temperature between the center and outside.

When an ingot is poured on a flat cast iron stool of the conventional type, the center becomes hot and tends to expand. This expansion puts the still cool outside area under tension which is relieved on cooling. Repetition of this stress

cycle is thought to be the cause of cracking. Whatever the cause, almost invariably these stools develop a central crack through the thickness of the stool extending from one edge toward the spot which is repeatedly heated first by the stream of molten steel.

The median life of these stools is 40 to 50 heats. A few of the stools last as long as 150 heats or more, which indicates that considerably longer life is possible if premature cracking can be prevented. If stool life were the only consideration, some improvement could no doubt be secured by alloy additions to the iron. This, however, would result

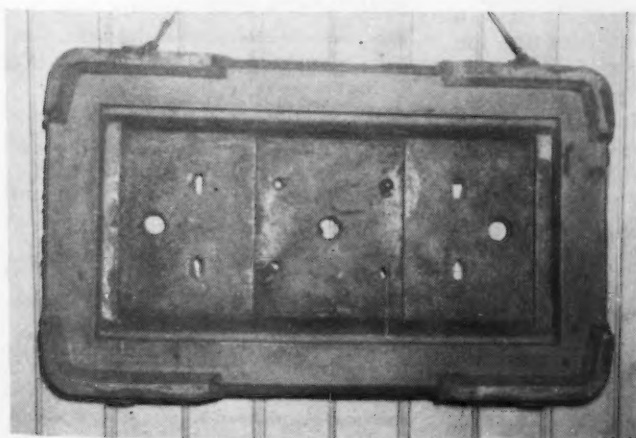


FIG. 1—The outside section of the ingot stool consists of a cast steel keeper, lined with cast iron.

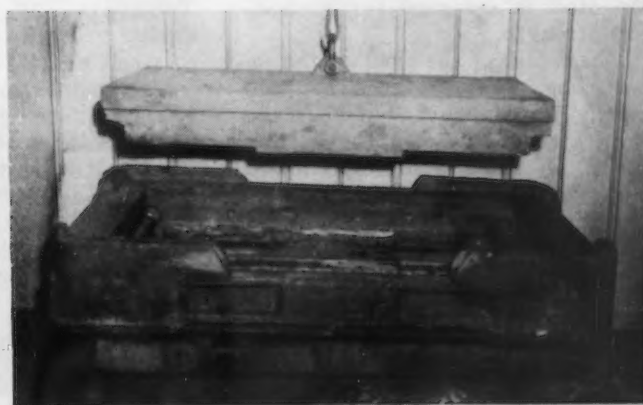


FIG. 2—The insert or center section of the stool is of cast iron. This section takes most of the thermal shock set up by the molten metal and is easily removed and replaced.

in undesirable contamination of the melt if the broken stools are used as cold iron in the open hearth charge. Thus, the best method of lengthening stool life is by improving the design so as to prevent undue temperature differences and, in this manner, avoid high thermal stresses.

Cast Steel Keeper

With these factors in mind, an improved design has been developed at Steubenville Works of the Wheel-



FIG. 3—This is the complete stool assembly, showing the cast steel keeper, the cast iron liner and the insert.

ing Steel Corp. (U. S. patent No. 2,134,970). The outside of this patented stool, which is normally the coolest, is made up of a cast steel frame or keeper. Into this keeper is poured an inner frame of cast iron. These two parts form the outer frame proper, Fig. 1, and are separate from the parts in contact with the ingot and which normally attain higher temperatures.

In a stool of this design, the temperature differences, and hence the stresses, in any one part are very much decreased. This part of the stool is designed for mechanical strength.

The center of the stool, or the insert, Fig. 2, is designed not primarily for strength, but to resist the extreme heat of the molten steel. By thus using specialized parts for the two distinct service requirements, the life of the central part is more than tripled. Another advantage is that only the part which fails needs replacement, not the entire stool. Breakage when loosening stool stickers, the immediate cause of failure of the conventional stool, is entirely eliminated.

The stool now being used by Wheeling, Fig. 3, is the result of several improvements over the orig-

inal model, each followed by an actual service trial, so that there is considerable well founded confidence in the soundness of this design.

The first set of 12 insert stools was put in service at Steubenville Works on Oct. 29, 1936, and was used until April 16, 1937, when it was taken off with an average of 245 heats or 1637 gross tons of ingots per stool. New inserts were made and were used from June 2, 1937, to Feb. 4, 1938, for an aver-

age of 356 heats or 5,052,100 lb. of ingots on the new inserts.

10 Stools Used

Ten insert stools were put in service the last part of March and now have over 500 heats on the original inserts. The stool consumption is about $\frac{3}{4}$ lb. of insert per ton of ingots. The detailed record of the 21 oldest composite stools is shown in Table I. A comparison with our practice on regular slab stools for the 12-month period ending October, 1941, is given in Table II. The stool consumption during this period was 11.8 pounds of stools per ton of ingots.

The comparison in Tables I and II refers to the grades and sizes of ingots made at Steubenville Works. The greatest part of the production there is low carbon rimmed steel. The ingots are all 24 in. thick and 30 to 60 in. wide, with one ingot poured on each stool.

Certain types of alloy steel are very susceptible to sticking. We have had no direct experience with this type of steel but have reason to believe that the insert type stool described here will give improved length of service, though perhaps not as long a life as we have found. Sticking will probably not be great-

TABLE I—Performance of Insert-Type Stool

Life of 21 Oldest Stools up to Jan. 27, 1942

Mold	Date	Heats	Tons	Weight of Insert per Ton of Ingots
21	3/28	636	4,781.4	0.59 Lb.
18	"	620	4,709.4	0.60 "
13	"	613	4,671.2	0.60 "
24	"	606	4,615.4	0.61 "
22	"	590	4,408.7	0.64 "
23	"	583	4,406.4	0.64 "
20	"	562	4,257.6	0.66 "
14	3/29	542	4,117.5	0.68 "
16	3/28	476	3,646.5	0.77 "
26	"	449	3,402.9	0.82 "
Sub Total		5,677	43,017.1	0.65 "
15	4/17	650	4,238.1	0.66 "
17	"	549	4,162.2	0.67 "
12	"	523	3,978.8	0.70 "
25	"	512	3,839.1	0.73 "
19	"	433	3,241.7	0.86 "
Sub Total		2,577	19,459.9	0.72 "
10	7/15	420	3,187.8	0.88 "
7	"	409	3,053.5	0.91 "
6	"	400	3,013.9	0.93 "
9	7/16	393	2,980.7	0.94 "
8	7/21	367	2,735.4	1.02 "
11	7/15	269	2,022.2	1.38 "
Sub Total		2,258	16,993.5	0.99 "
Total		13,089	79,470.5	0.74 Lb.
Weight of Stool:—				
Steel Casing				4,000
Cast Iron Frame				3,600
Center Insert				2,800
Total				10,400

ly changed but the advantage is expected to result from less breakage during loosening of the stickers. The steel frame is strong enough to withstand treatment that would break the conventional cast iron stool. No trouble due to loosening the inserts has been experienced.

Another service condition not encountered at Steubenville is that of pouring several ingots on one stool. This condition is covered by providing a separate insert for each of the ingots. The inserts may be renewed individually as their condition requires. This feature of renewability results in saving in cast iron, and in foundry labor, the release of foundry capacity for other uses, and savings in open hearth stool cost.

TABLE II—Performance of Slab Type Stools

Month	Stools Scrapped	Ingots Produced
1940 Oct.	143	12,387
Nov.	70	11,856
Dec.	91	11,453
1941 Jan.	128	12,115
Feb.	114	11,046
Mar.	151	11,748
Apr.	155	12,135
May	115	11,891
June	129	12,156
July	164	11,305
Aug.	143	11,604
Sept.	115	11,604
Total	1,518	141,612
Ingots on Insert type stool		7,216
Ingots poured on regular stool		134,396

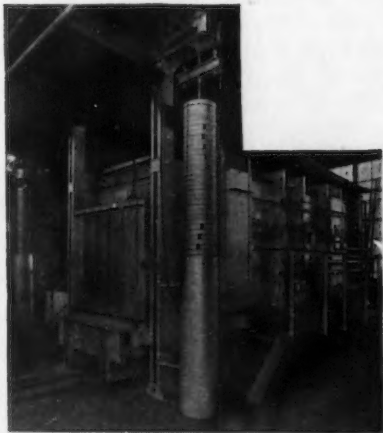
This is equal to 88.5 ingots poured per stool.
 $\$140$ (4 tons @ $\$35$) \times 1,518 = $\$212,520$.
 Cost of Stools from Oct. 1, 1940, to Oct. 1, 1941.
 $1,029,774.3$ tons poured on these stools.
 Cast iron stool cost per ton of ingots — $20.7\frac{1}{2}$
 $8,000 \times 1,518 = 12,144,000$ lb. of stools consumed, or —
 11.8 lbs. of stools used per ton of ingots.

New Equipment . . .

Heat Treating and Processing Controls

Newcomers into the fields of heat treating, heat-treating controls, temperature and atmosphere controls, and other equipment within the heat treater's scope are discussed herein.

BETTER metallurgical results are claimed for a new line of heat-treating furnaces featuring an individual motor drive. Shown here is one of a battery of four 5-ton furnaces used in the hardening, normalizing, annealing, stress relieving, and tempering pro-

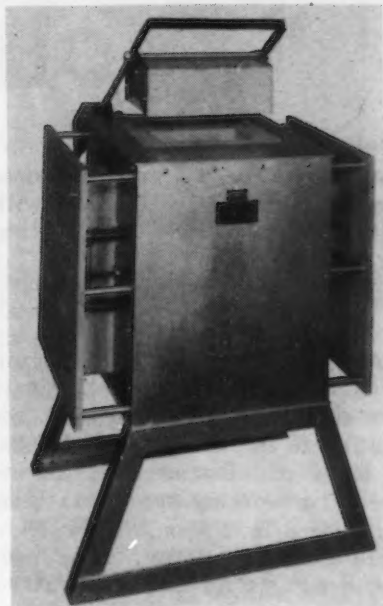


cesses. These furnaces, propane fired, are of the car hearth type, and have automatic dampers for atmospheric control. Larger furnaces of the car hearth type, standard and special design, are made, with capacities as great as 100 tons per charge and meet the wide range of industrial heat-treating requirements with economy and high productivity. They are available for oil, gas, or electric firing, and built by R. S. Products Corp., Philadelphia.

High Speed Tool Hardening

AFURNACE for hardening small tools or for tools that require the hardening of a short end only has been developed by the Sentry Co., Foxboro, Mass. The furnace is of a controlled atmosphere type, the atmosphere being produced by the use of Sentry Diamond blocks and is the correct neutral atmosphere for molybde-

num, cobalt, or tungsten high speed steels. The tools are charged in a vertical position to eliminate warpage or change of shape. The furnace has a maximum rating of 16 kw. with a normal operating consumption of 4 to 8 kw. per hr. Heating time from cold to 2350 deg. F. is less than an hour, and the shell is insulated for 2500 deg. F. operation. Heating elements along side the muffle provide uniform

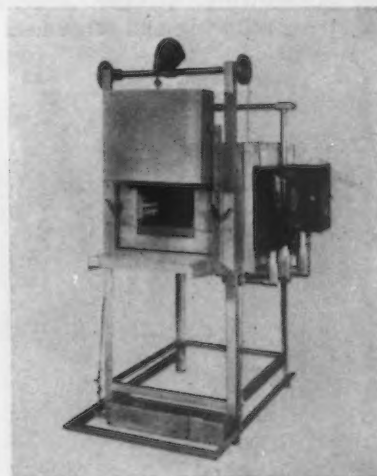


muffle temperature, and shielded electrical terminals of a patented air-cooled design eliminate any necessity for a water-cooled terminal system. Direct connection with either 110 or 220-volt supply can be made without the use of a transformer.

General Purpose Furnace

H. O. SWOBODA, INC., New Brighton, Pa., announced recently the production of a new line of Falcon electric box type and muffle type furnaces, well adapted to a wide range of general and

specific applications for use in either the factory or laboratory. These furnaces are being used for testing metal samples, glass melting, refractory burning, oxidation determinations, vitreous enamel



testing, heating high speed and similar steels in tool rooms for hardening and tempering and for other uses. Built for either bench or floor mounting, heavy alloy heating elements assure efficient, long-life operation at temperatures up to 2300 deg. F. Heating elements are supported in high grade refractories arranged in the top, bottom, side and rear walls of the furnace chamber, which is surrounded by durable block type insulation.

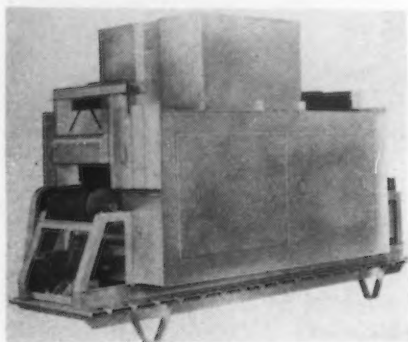
Rotary Forge Furnace

A NEW rotary forge furnace, recently announced by the Rhode Island Tool Co., Providence, has several patented features that aid both in reducing fuel costs and in increasing production. In the new furnace, the burned gases are so handled and distributed that extreme uniformity of heat is attained. Atmospheric control prevents scale formation, and there is

no fly ash to cause wear on the forging tools. The forge ring is indexed by depressing a foot control, leaving the operator's hands free. Rings can be furnished to accommodate a wide range of bar stock sizes. Rings for the 24-in. furnace will handle stock $\frac{3}{8}$ to $1\frac{1}{4}$ in., and rings for the 36-in. furnace will handle stock $1\frac{1}{4}$ to $2\frac{1}{2}$ in. Rings can be interchanged, even when hot. The burner may be fired by bunker oil, Nos. 2 or 3 fuel oil, natural, or artificial gas.

Convection Heated Furnace

A NEW conveyor type convection heated, low temperature heat-treating furnace has been developed by the *Gehrich Corp.*, Long Island City, N. Y., for preheating, drawing, normalizing, holding, annealing, stress relieving and other heat-



ing operations up to 1250 deg. F., on small metal castings, slugs, stampings and forgings. The furnace has an alloy steel interior, eliminating the use of refractory linings or brick. The heat source consists of electric resistance elements, with fan circulation of the furnace atmosphere. The same furnace can be arranged for gas or oil fired external heaters. The conveyor consists of a wire mesh belt running over steel drums at both ends of the oven and is driven by a variable speed motor drive.

Low Temperature Furnace

A NEW heavy duty CF type furnace, built by the *Despatch Oven Co.*, Minneapolis, is used to heat treat materials uniformly and accurately in temperature ranges from 300 to 800 deg. F. Materials are loaded into the furnace on removable shelves spaced on 3 in. vertical centers, and the working

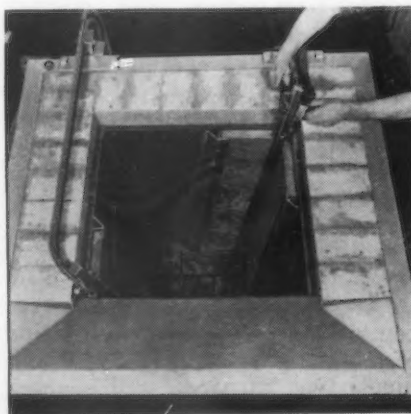
chamber measures 13 x 13 x 13 in. The furnace has a high volume, high pressure fan, and special heat distributing and recirculating ducts so that horizontal air flow above and below each shelf is obtained.



Uniformity is ± 5 deg. F. The furnaces are made in a variety of sizes and designs, and are available with either gas or electric heating systems.

Salt Bath Furnace Pots

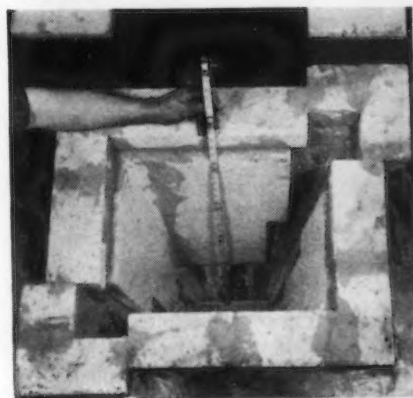
A NEW improved design change in the method of insulating pots for electric salt bath furnaces, resulting in the use of fewer bricks, a lower maintenance, and an increase in working space, has been announced by *Upton Electric Furnace Division*, Detroit. The new pot design is for low temperature



work and such work as does not require brick insulating except at the corners where electrodes are placed. Instead of lining the entire floor and wall surfaces of the pot, only the floor and space behind the electrodes requires the insulating material. Angle iron with a bracer strip, welded to the pot walls, hold the bricks in position. When the bricks are renewed, they are slid out at the top and replaced with new brick. A single bolt connects each electrode with its respective water-cooled bus bar, permitting electrodes to be changed by hand independently of each other.

Improved Pot Design

A NEW improved salt bath furnace pot design, especially deep, for handling high speed tungsten and molybdenum steel saw blades, has been announced by *Upton Electric Furnace Division*, Detroit. Used for the high heat hardening stage, this type of deep pot can also be used for long broaches, knives, etc. It is



30 in. deep by 18 x 12 in. at the top, and handles up to 6000 blades per day, in 30 batches of 30 blades each per hr. at 2350 deg. F. Molded insulating material extending from the top to bottom of the pot is backed by a layer of ceramic insulating bricks that cover the sides and bottom of the working space and the alloy steel pot, which is separated from the outside welded plate shell by additional insulating material.

Furnace Inspection Door

A FURNACE inspection door, especially designed to withstand high temperatures and applicable to various types of industrial furnaces, heat treating fur-



naces, boilers and kilns having continuous temperatures up to 2500 deg. F., has been developed by the *Gillette Kiln Sales Co.*, 723 Investment Bldg., Pittsburgh. The door consists of a cast iron slide which rises vertically in a cast iron frame assembly. The door has no moving parts to warp or stick. To open, the slide is raised bringing a framed, pyrex heat resisting, glass opposite the port hole. When an instrument or tool is to be inserted into the furnace, the Pyrex slide is raised completely above the brick-work port. The door is easily installed on new or existing furnaces. The complete door is furnished, and may be had with either blue or clear glass, and also with four sets of anchor bolts.

Soft Metal Melting Pots

THE new type P Chromalox melting pots for solder, lead, babbitt, tin and other soft metals except zinc, are rated from 250 to



9000 watts for operation on 115, 230 and 460 volt, single phase, a.c. Melting capacity is 10 to 920 lb.,

depending upon the pot size. Heat limiting controls, electrical safety equipment, low radiation losses and maximum efficiency are among the features of these pots. *Edwin L. Wiegand Co.*, Pittsburgh, is the manufacturer of these items.

Cold Treater

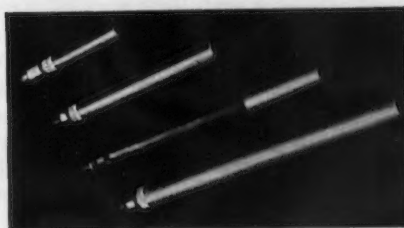
A NEW industrial type sub-zero cold treater refrigerator, maintaining temperatures at -35 deg. F. for laboratory research, testing, production processing, aging, manufacturing and assembly was recently announced by the



Jewett Refrigerator Co., Inc., Buffalo. These refrigerators are used in airplane, chemical, rubber, machinery, instrument and other industries, and are built in 3 and 6 cu. ft. capacities. Standard control maintains temperatures from $+5$ to -10 deg. F., and special control gives temperatures from $+20$ to -35 deg. F. Specialized types of racks, containers, or shelving can be built into the cabinet.

Thermocouple Protector

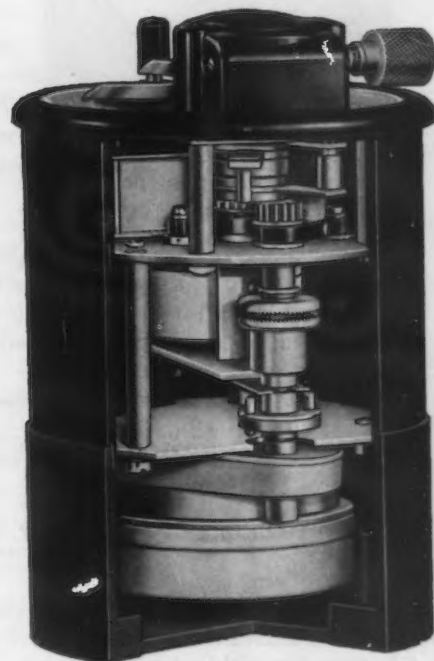
A NEW type carbolast thermocouple protecting tube developed for use in molten metals and heat treating applications at temperatures up to 3000 deg. F., has



been announced by *Elematic Corp.*, Blue Island, Ill. The tube is a metallized refractory, light in weight and high in mechanical strength, and slag, molten metals and most condensates do not adhere to it. Because the tube disintegrates by sublimation rather than chemical action, there are no metals or temperatures to limit its use, and it can be used interchangeably in different metals without fear of contamination.

Time Relays

TIME relays, types RSIC and TDIC, developed by *R. W. Cramer Co., Inc.*, Centerbrook, Conn., are synchronous motor operated timers that either keep an electrical circuit closed for a preset time interval or can be used as time



delay relays which, when energized, keep a circuit open for a selected interval. These timers have instantaneous reset features and when restarted, repeat the timing without manual resetting. They are available with an inbuilt manual start button, or can be supplied for a remote control start button. Auxiliary contacts can be furnished for audible or visual signal circuits. Various safety features and features to insure long life of the relays are built into them, and they can be set very accurately by a micrometer adjusting knob.

Controller

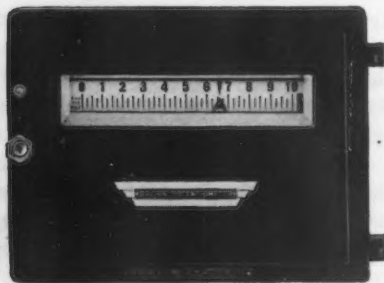
FOR controlling temperature, pressure, liquid level and liquid flow, the *Foxboro Co.*, Foxboro, Mass., has announced an improved *Stabilog* controller, model 30. A dual pressure indicator replaces the customary two small gages, and all operating adjustments are made from the front of the case; the adjusting mechanisms for changing the control point, throttling range,



and reset resistance being accessible when the door is opened. The operating mechanism, however, is protected and concealed behind a removable plate. Operating features are described by the instrument's three functions: (1) Proportional, providing uniform pneumatic proportion action; (2) Reset, establishing stabilization at any desired point of control; and (3) A function that is a temporary additional correction, operating entirely automatically. The controllers are furnished in recording and indicating models.

Pickling Tank Control

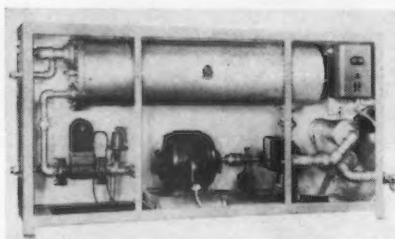
A TEMPERATURE control system for pickling tanks which has been designed not only to overcome the difficulties arising from corrosive conditions in the pickling room but to lend itself to ease of manipulation as well as accuracy in operation, has been developed by



Brown Instrument Co., Philadelphia. Uniform temperatures, shorter pickling time, lower steam costs, saving of acid, reduction of personnel and machinery injuries, and reduction of discomfort to personnel are among the advantages claimed for pickling systems using this controlling mechanism. A similar control system has been designed for use with sheet tinning pots, providing close control and ease of operation essential to good tinning practice. Both the tin bath temperature and palm oil temperature are controlled by this system.

Quench Oil Coolers

A COMPLETE line of rapid oil coolers, used to maintain constant temperature in oil quench baths, are built by the *Bell & Gossett Co.*, Morton Grove, Ill. A complete engineering service in connection with the design and instal-



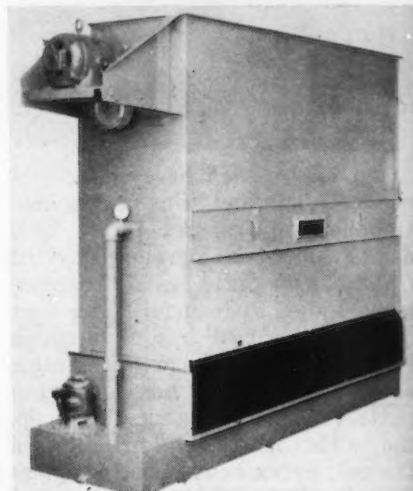
lation of the oil cooling systems is offered by the manufacturer. The unit is self-contained, combining all necessary equipment except the quench tank itself. The coolers cover a wide range of capacity requirements from the smallest to the largest.

Quenching Oils

FOR rapid quenching essential in heat treating high explosive shells, *E. F. Houghton & Co.*, Philadelphia, has announced a new and proved quenching oil, named *Houghto-Quench G*. This oil was designed specifically to meet the proper range of physical properties, including fire, flash and viscosity, as well as stability, freedom from sludging and rapid quenching speed. It contains a chemical agent that acts as a stabilizer and reduces oxidation or fractional distillation. A synthetic wetting agent is also embodied in the oil to provide rapid wetting-out properties, spreading a continuous film of oil speedily over the hot surface of the metal and preventing the formation of gas pockets.

Liquid Cooler

THE *Niagara Blower Co.*, 6 East 45th Street, New York, has announced a new evaporative type of unit for removing heat from various fluids, oil lubricating systems, soap, chemicals, coolants and other solutions. The unit consists of a casing containing tubes through which hot liquid passes. A spray system drenches the tubes con-



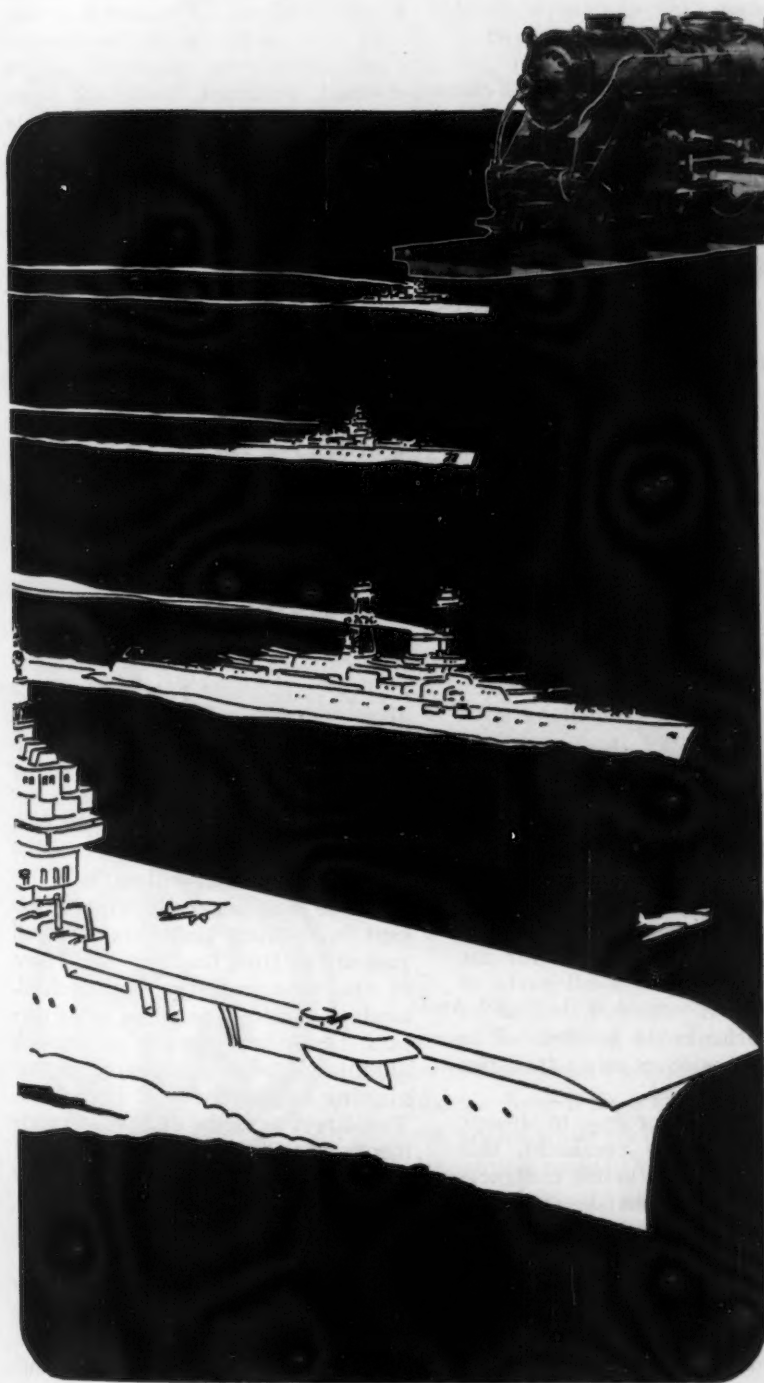
stantly with circulated water and air is drawn through the sprayed coils by a fan. Only water evaporated is consumed, saving 95 per cent of the water ordinarily used with shell and tube heat exchangers. The air can be by-passed to maintain a constant liquid temperature. A heating coil in the tank can be used to preheat solutions, prevent freezing in winter, and prevent separation of high melting point fats from solution. Applications have been found in wire drawing, heat-treating and chemical processing departments, as well as machinery lubricating systems and diesel engine power plants.

Carburizing Compound Cleaner

TURNER Engineering Co., Milwaukee, has announced a carburizer screening machine that cleans carburizing compounds economically and efficiently. The carburizer is fed automatically from a built-in hopper at the top of the machine into the inclined rotary screen. It is then pushed upward at the rate of 1000 lb. per hr., over 23½ ft. of screening surface. The non-usable material is deposited in the bottom of the machine, and the rejuvenated compound flows out, aerated and clean, and ready to use again.

Model trains changed into Naval instruments

...through cooperation between Lionel and Revere



It's hard to say who gets the more enjoyment out of Lionel electric trains and accessories . . . a boy or his father. But it is certain that both are experts in appraising the accuracy and *realness* of scale models. So the Lionel Corporation has had long experience in precision manufacturing for this ultra-critical market. And that proved the best of preparation when Lionel got into the production of Naval instruments in addition to model trains.

But any departure as great as this is sure to create problems. Not only did new equipment have to be selected, but the brass to be used was of a different analysis requiring entirely new methods.

Here is where a Revere Technical Advisor was able to perform an essential service. Revere's exceptional knowledge of brass, of fabricating processes and methods, aided Lionel greatly in setting up all the new operations and fitting them smoothly into volume production.

In this way Lionel has quickly taken an important place in America's war effort . . . and Revere once again has been able to contribute both the metals and the specialized knowledge of copper alloys which have sped so many such projects forward to success. Through the Revere Technical Advisory staff this same service is available to you. Why not get in touch with Revere now?

REVERE

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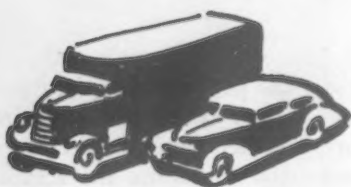
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Assembly Line . . .

• Willys now employs more men on war goods production than on auto production in recent years . . . War work brings reorganization of Fisher Body's top personnel . . . G-M to play bigger role in aircraft parts business.



DETROIT—Among the independents in the automobile industry are the best examples of all-out conversion to war production. An example of this is Willys-Overland at Toledo which today is employing more workers on war production than it has employed in peace-time automotive production for a goodly number of years. The plant itself is a beehive of activity and even the offices have been greatly expanded as war work undertaken by the company has been planned, tooled and finally put into production.

Willys at one time employed some 18,000 men in its plant, but that was back in the days when the company's sales volume was an important figure in the automotive listings each year and before the vicissitudes of business had virtually closed the plant. In recent years factory employment has hovered in the bracket between 1500 and 3000 employees but, since the defense program got underway, employment has jumped steadily and in the last year has increased from 3000 to approximately 7500 men. Shortly the company expects to employ another 4500 on additional war work, bringing the employment level up to 12,000.

Barely a year ago Willys' offices occupied less than two floors of the monumental white administration building, but today six floors of the building are crowded with office

workers, draftsmen, engineers and executives.

What is seen here amounts to 100 per cent conversion of a plant and its executive engineering and production talents to war production but unfortunately it cannot yet be labeled as a 100 per cent all-out production program. What are lacking are orders, yes, more orders and schedules that will occupy every machine, every assembly line and every forging and indications are that Willys is doing everything it can to get the "go-ahead" on more war work as soon as possible.

NEVERTHELESS automotive men who have had a nostalgic feeling since the first of the year because there are no longer any big production figures to talk about, would get a mental and spiritual lift out of seeing the volume of goods now being turned out in the Willys plants.

Of course, production figures are taboo on military products, and all Willys makes now are military products. However, it is common knowledge that Willys, along with Ford, is supplying large numbers of "jeeps," or "peeps" as the selectees have named the quarter-ton, four-by-four trucks. Suffice it to say that the assembly lines are turning out these tough little trucks in as steady a stream as normally comes off the passenger car assembly line. They are labeled for use by United Nations in all parts of the world. If required, output of these vehicles could be doubled or even tripled with existing facilities used to the utmost.

Altogether, according to Joseph W. Frazer, Willys president, this independent has 20 prime contracts in addition to numerous sub-contracting jobs. This would indicate that Willys has a greater variety of war work concentrated in its plants than any other automotive plant its size, and it at least approaches the biggest companies in the number and variety of jobs it has undertaken.

Operating at Willys, but only at part of its capacity, is an aluminum forging plant—the second largest in the country.

(Seeing this forging capacity only partly at work isn't surprising to anyone at all familiar with the indecision that still seems to mark

the aircraft program. Lack of balance in production schedules, constantly shifting delivery date requirements, fluctuation in volume requirements, plus changes in design that seem to be all-too-frequent, have been earmarks of the aircraft program from the start and seem to be still with us. It is understood, for instance, that this forge plant has been operating five days a week normally with an erratic spurt now and again to six- or seven-day operation.)

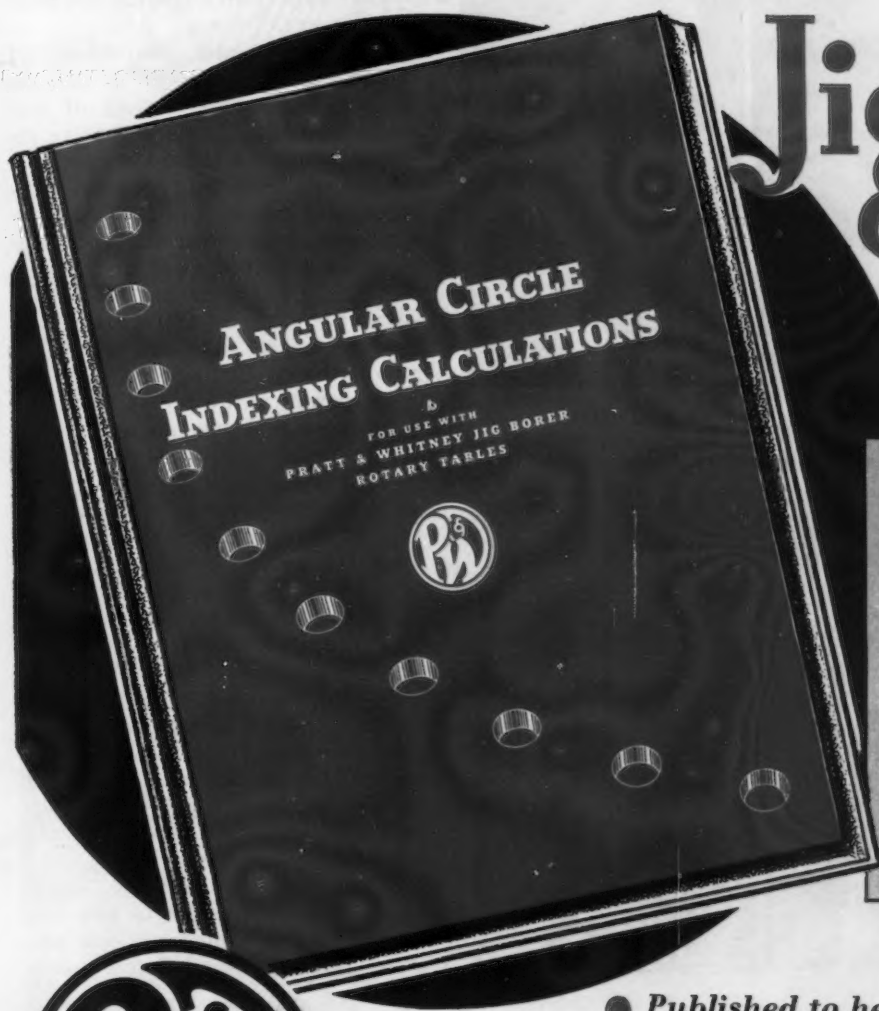
Directly bearing on this is a statement by Mr. Frazer that this plant could handle a much heavier volume of work if the orders and schedules were forthcoming.

BACK in late 1940, when the question of an aluminum shortage first arose, it was stated, by men who are experts, that aluminum forging capacity was much more critical than the metal situation itself. At that time the few aluminum forging experts in the country professed that the ability to hammer parts out of hot aluminum billets was a mysterious art that no one else could accomplish. While criticism was rising to a peak, there was a sudden decision to have Willys enter the field as an important addition to the aluminum forging industry.

(It is not generally known, except in Detroit, that this occurred just at the time that the Big Three of the auto industry had decided, against outside advice, to make certain that there would be enough aluminum forging capacity by beginning experiments of their own. The direct outcome of these experiments was Chrysler's establishment of an aluminum forging plant after it had explored all of the possibilities and learned the art of making aluminum forgings.)

An impressive thing about the aluminum forging set-up is the size of the hammers required for relatively small pieces of work. Hammer men say that the forging of an aluminum alloy part requires a blow about seven times as hard as that required to form an equivalent steel part. Moreover, the equipment must be in excellent condition to turn out the quality of work desired. Many of the hammers at the Willys plant, it was observed, are new, and all of them have been

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Machine Section



J. W. JACKSON
General Manager of the
Ternstedt Manufacturing
Division

placed on new foundations. In reports last week on the plans of William L. Batt, WPB director of materials, for expanded production of magnesium and aluminum, it was pointed out that aluminum alloy crankcases for large aircraft engines are forged with 35,000 lb. hammers while a typical automobile industry hammer runs about 16,000 lb.

FORD MOTOR CO. will participate in a very important way in the magnesium program in which six companies have contracted to produce 157,000,000 lb. of magnesium by a new ferro-silicon process which requires less electric power and produces magnesium at a more rapid rate. Other companies which will engage in this work are Union Carbide and Car-

bon Co., American Metal Co., National Lead Co., Permanente Corp., and the New England Lime Co. This program will be added to one which calls for 144,000,000 lb. of magnesium to be produced by the electrolysis method by Dow Chemical Co., using brine deposits near Ludington, Mich. Dow, of course, has been the pioneer in magnesium production at Midland and in Texas, producing currently more than 50,000,000 lb. yearly. The new salt brine wells are expected to be three times as productive as the old wells at Midland. The magnesium metal is used for aircraft parts and incendiaries.

The comparison of the ferro-silicon process and the electrolysis process indicates electric power savings of 30 to 40 per cent with the ferro-silicon process. Where-

as the Dow process makes use of the magnesium extracted from brine, the newer process extracts magnesium from dolomite, the magnesium ore.

The complete conversion of Fisher Body Division of General Motors Corp. to a variety of war work has required an extensive reorganization of Fisher's top personnel. E. F. Fisher, general manager, and one of the seven Fisher brothers, announced the reorganization early this week and at the same time disclosed that Fisher has begun work on several new, important armament jobs, including two artillery carriage projects for high power anti-aircraft weapons, a machine tool job, an augmented Naval ordnance parts program, a new airplane parts job, and many other miscellaneous jobs. All of this is in addition to Fisher's extensive bomber work and the big tank job it has undertaken.

Within the Fisher executive set-up there have been established Defense Project Sections, each section solely responsible for specific types of work. Those named are an Aircraft Section, Tank Section, Artillery Carriage Sections, Ordnance Specialties and Machine Section and the Ternstedt Manufacturing Division.

When Fisher originally undertook production of parts and sub-assemblies for bombers a year ago, a Defense Unit was created.

A. J. FISHER, another of the brothers, has been named director of the Aircraft Section.

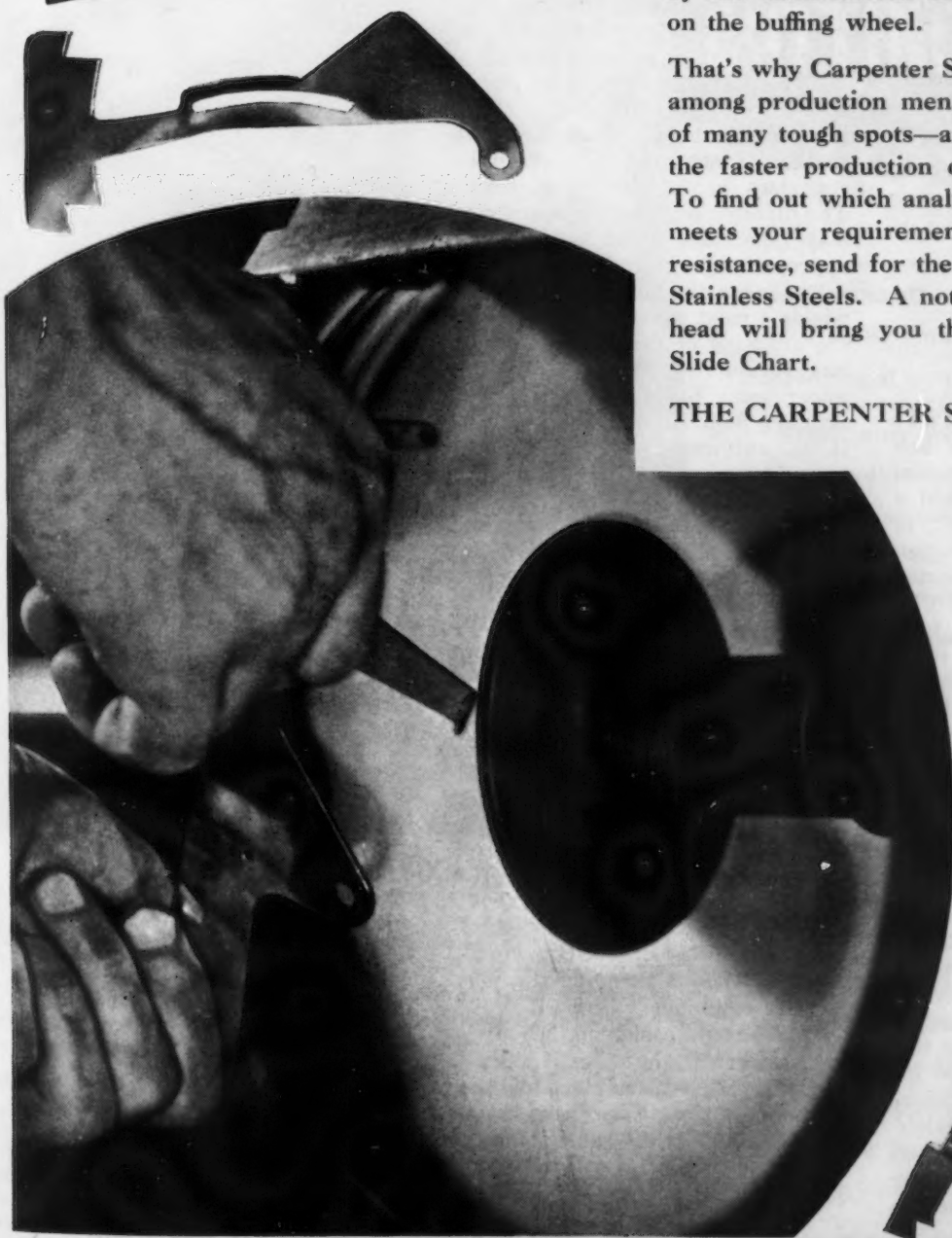
Del. S. Harder, general factory manager of Fisher's fabrication plants, has been named director of the Tank Section, with G. H. Kublin as chief engineer. The company is proceeding more rapidly than anticipated with its work on tanks and is nearing the production stage.

G. S. Cashdollar, manager of a stamping division, was named director of one of the Artillery Carriage Sections which will produce carriages for a new type anti-aircraft gun of great weight, range and mobility. F. B. Harrington was named assistant to Cashdollar, with Bert Cotter as chief engineer.

Another Artillery Carriage Section will produce a different type and caliber anti-aircraft weapon, with production expected to be at the fastest rate yet set up for this

(CONTINUED ON PAGE 118)

FOR *Speedier* PRODUCTION OF Stainless PARTS



FROM the press room straight through to the finishing department, this Stainless Strip speeds your wartime production.

Intricate shapes and high precision are more readily obtained because of its uniform temper and absence of hard spots. Tool troubles diminish for the same reason. Faster press speeds and steadier output result from its uniform response to press operations. Even buffing time is cut down by the satin-smooth finish that brightens quickly on the buffing wheel.

That's why Carpenter Stainless Strip rates so high among production men. It has helped them out of many tough spots—and is now making possible the faster production of vital wartime products. To find out which analysis of Stainless Strip best meets your requirements for corrosion and heat resistance, send for the Carpenter Slide Chart on Stainless Steels. A note on your company letterhead will bring you this handy, quick-reference Slide Chart.

THE CARPENTER STEEL CO. • Reading, Pa.

Carpenter STAINLESS STEELS

BRANCHES AT Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia

Washington . . .

• WPB reluctantly adopts procedure for appeals from its production and material limitation orders . . . Process is more complex and cumbersome than previously . . . Before an appeal may be granted it must be signed by nine WPB functionaries.



WASHINGTON—Appeals from WPB production and material limitation orders have forced the agency to add a reverse gear to its machinery, in the form of a regular appeals procedure. The procedure was adopted reluctantly because WPB policy is to discourage appeals. WPB contends that they slow down the work of the agency. Appeals also are frowned upon by organized labor and the WPB labor division. But the granting of appeals has not always been opposed by the labor division.

The standard appeals clause appearing in WPB orders was sired by the labor division at a time when it was chiefly interested in priority unemployment. Back of the switch in the division's policy is its insistence on "union security." Its interest in priority unemployment has waned because as the result of the speeded-up tempo of defense production the division wants to see that union labor quickly cashes in on better paying jobs. These jobs now abound where previously they were not so plentiful.

THE standard appeals clause reads as follows:

"Any person affected by this order who considers that compliance therewith would work an exceptional and unreasonable hardship upon him, or that it would result

in a degree of unemployment which would be unreasonably disproportionate compared with the amount of (insert name of material) conserved, or that compliance with this order would disturb or impair a program of conversion from non-defense to defense work, may appeal to the War Production Board by letter or telegram, Ref: (insert priority number) setting forth the pertinent facts and the reason he considers he is entitled to relief. The director of industry operations may take such action as he deems appropriate."

The labor division of WPB which wields a most powerful influence in the granting or denying of appeals has formulated and is operating under some novel and not to say amazing policies in this connection. It is uniformly denying appeals from freeze orders requesting small amounts of material to enable an employer to keep men working, unless it will tide him over until he can convert. The same policy is being followed in connection with production limitation orders where a manufacturer seeks to lessen his loss through fabrication of partially processed materials. Moreover this division has lobbied, unsuccessfully, for more stringent freeze orders.

ONE labor division official recently told THE IRON AGE that "we don't give a . . . about how many men are thrown out of work. Our problem is labor supply—having enough men for the jobs that are available."

Another spokesman of the division in explaining these policies said that the reason was that the division's duty is to promote labor security which is the same thing in which the unions are interested. Both the division and the unions are urging quicker conversion so that more of the men can obtain the resulting advantageous contracts. If a manufacturer were given time to utilize his inventory, it would mitigate against labor, since the men held in his organization would not be able to get in on the upswing until he did convert. Labor shortages were pointed out in Detroit,

where it is expected an additional 200,000 workers will be needed. Unemployment compensation is being recommended as a cushion for workers facing dislocation.

ON the other hand, it is interesting to note that while the labor division has had its way in production limitation, apparently, it is bruited that WPB Chief Donald M. Nelson put his foot down on unnecessary freeze order applications where the government would not benefit.

Prior to WPB reorganization, procedure was fairly simple. A manufacturer would send in his complaint to WPB and it would be routed to the proper commodity branch. The administrator of the order would make his recommendation denying or affording the relief, which had to be concurred in by the priority specialist, and the legal advisor.

Now, appeals procedure is much more complex and cumbersome. Before an appeal may be granted, it must be signed by nine WPB functionaries. Among these are representatives of the labor division, civilian supply division, industrial conservation bureau, industry branch, priorities branch, legal division, and review and approval branch.

Present procedure on appeal involves the filling out of a form made up for WPB by the Securities and Exchange Commission by the industry branch. The order appealed from must be indicated and the reasons for the proposed action in sufficient detail to make understandable, and the action recommended must be shown.

A SUPER-APPEALS group has been set up to give final review in cases where relief has been granted and to handle reappeals where relief has been denied.

To illustrate the labor division's policies on appeals, a Minnesota refrigerator company was denied a small amount of chromium which it claimed would help it keep its organization intact. The division's reason given for its denial was that there is a plentiful labor market in



STOP LADLE LINING CUTTING *with* "695"

● Here is another of the many practical uses of 695 Plastic—manganese steel producers are employing it as a ladle lining.

Mixed only with water and quickly applied, 695 consolidates at usual ladle temperatures into a hard, dense monolith that resists abrasion by the rushing, molten steel. Result—linings last much longer and release fewer impurities to contaminate the ingots. The 695 lining, furthermore, does not rob the metal of manganese content.

695 is a magnesia plastic refractory, proved by its scores of successful applications in open hearth and electric furnaces. Because of its unusually high plasticity, it flows readily into holes and crevices in the hot furnace and coalesces rapidly with the adjoining structure to form a solid, lasting repair. It is ideal for repairing tapholes, still by far its largest single use. Other equally valuable uses include lining furnace spouts and runners, patching open hearth front and back walls, repairing port floors and uptakes, patching monkey walls, and capping and facing bridge walls.

695 Plastic, stocked near the furnaces in convenient 100-lb. bags, may save many minutes of valuable production time whenever hot repairs must be made.

Basic Refractories for the Steel Industry:

MAGNEFER—Dead-burned dolomite for hearth and slag line maintenance.

SYNDOLAG—Dead-burned dolomite, smaller in grain size than Magnefer.

BASIFRIT—Quick-setting magnesia refractory for new construction, resurfacing and general maintenance.

OHIO MAGNESITE—Domestic dead-burned high-magnesia grain refractory, equal to Austrian.

HEARTH PATCH—For deep hole patching and other quick repairs in the basic open hearth.

GUNMIX—A basic refractory with chemical bond, sized for use with a cement gun.

RAMIX—An air-setting basic refractory for rammed hearths and cold furnace repairs.

695 PLASTIC—Strong plastic with basic and neutral properties, for hot and cold repairs.



HIGH-GRADE PREPARED REFRACTORIES FOR THE CONSTRUCTION, MAINTENANCE AND REPAIR OF BASIC OPEN HEARTH AND BASIC ELECTRIC FURNACE HEARTHS

BASIC REFRACTORIES, INC.
FORMERLY BASIC DOLOMITE, INC. CLEVELAND, OHIO

St. Paul, and besides, the division said that the company could seek substitute materials. In another instance a Michigan bowling alley manufacturer wanted to keep 140 men in production through the use of 11,000 lb. of stainless steel out of inventory. The division denied this appeal as well, claiming that local conversion would absorb any unemployment. Another concern making fishing reels asked for enough chromium to give 45 days' employment to 75 workers. The plant was already 50 per cent on war production, and would shortly go to 75 per cent. The division recommended the use of unemployment insurance to take care of the workers.

But an Ohio manufacturer of radiator grills was granted a small amount of chromium considered necessary to hold employees together in the interest of defense. It did not take this producer long to shift his plant and labor to shell making.

THESE rulings might seem reasonable considering the scarcity of chromium, and the relative unimportance from a war standpoint of the articles of manufacture, but the labor division selected

these cases for publication. No estimate is available of the cost to the employers affected who might have saved many thousands of dollars if they had been given small amounts of the metal to enable them to dispose of partly-manufactured products. This action was strictly in opposition to Mr. Nelson's declared policy of permitting the fabrication of partly processed units in fairness to the financial interests of businesses, and as a preventive of complete destruction of them by the war effort.

In spite of the labor division's potency in its recommendations on conversion and production limitation, organized labor is insisting that the division be reshuffled and men from the ranks of labor be given policy making jobs. Already its ambitious pressure tactics have driven from the division, economists whose work generally was accepted as objective.

Paradoxically, the labor division has been so zealous in urging its union-inspired policies that it has become the center of strife between itself and the other WPB divisions on the question of allowing appeals, whether the solutions depend on economic, metallurgical, or engineering factors.

Mullen Denounces Hearings On Structural Steel Labor

Washington

• • • Proceedings last Thursday under the Walsh-Healey Act involving organized labor demands on the fabricated structural steel industry which the industry said would (if granted) wipe out small shops were abruptly interrupted by Thomas Mullen, Lehigh Structural Steel Co., Allentown, Pa., who denounced the hearing as a criminal waste of time.

Addressing Major Robert N. Campbell, a member of the Public Contracts Board, who presided at the hearing, Mr. Mullen with some heat pointed out that the Walsh-Healey Act was passed five and one-half years ago in a period of economic depression and was intended to spread work and eliminate the sweatshop. He said it was not directed at industries such as fabricated structural steel whose wages are among the top rates paid in the country. At a time when the government is calling upon all industry not to lose an hour on producing for the war effort, and when the fabricators are fully exerting themselves to that end, Mr. Mullen said it was a criminal waste of time on the part of both the government and the people to conduct such a hearing.

Mr. Mullen declared that if in five and one-half years the Department of Labor has not established a wage rate that the need for such a rate is long since past. He pointed out that while labor may have needed a "blood transfusion" then, the patient has now been cured and there is no need for the Department of Labor to use the public's time and money to go any further in the matter of wage determination.

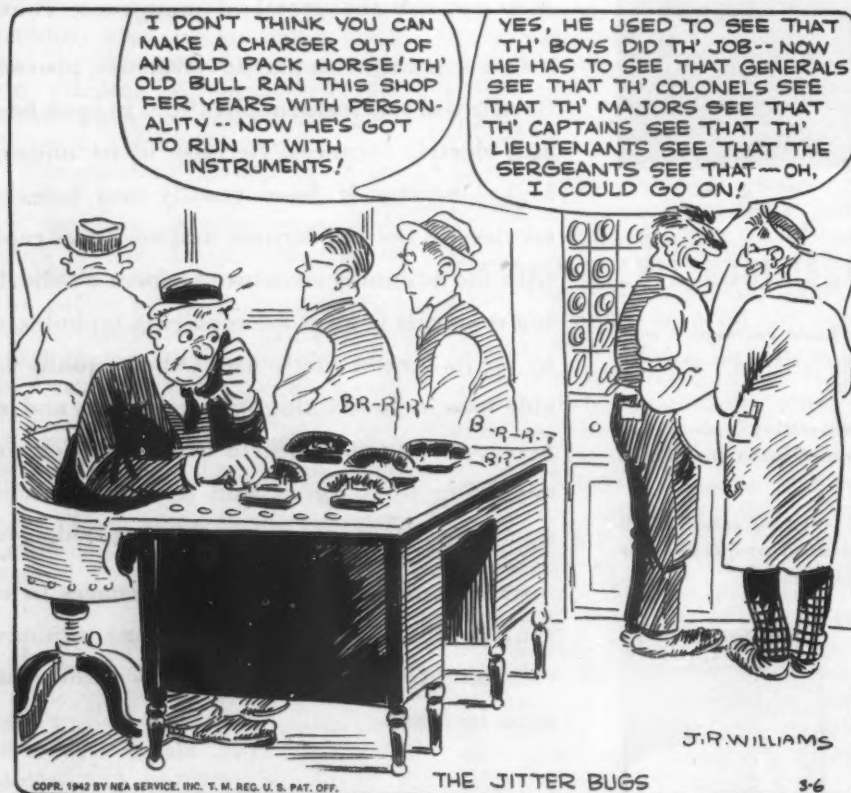
"Indeed," said Mr. Mullen, "Congress is being besieged to abrogate the 40-hr. provision of the Walsh-Healey Act to help shorten this war."

"I am hopeful that labor and industry will both urge longer hours on all war work at straight time. A 48-hr. week is a 20 per cent increase in work time and a 60-hr. week would give us a 50 per cent increase in work time and a correspondingly larger increase in production."

Mr. Campbell replied that Mr. Mullen's remarks should be a mat-

THE BULL OF THE WOODS

BY J. R. WILLIAMS





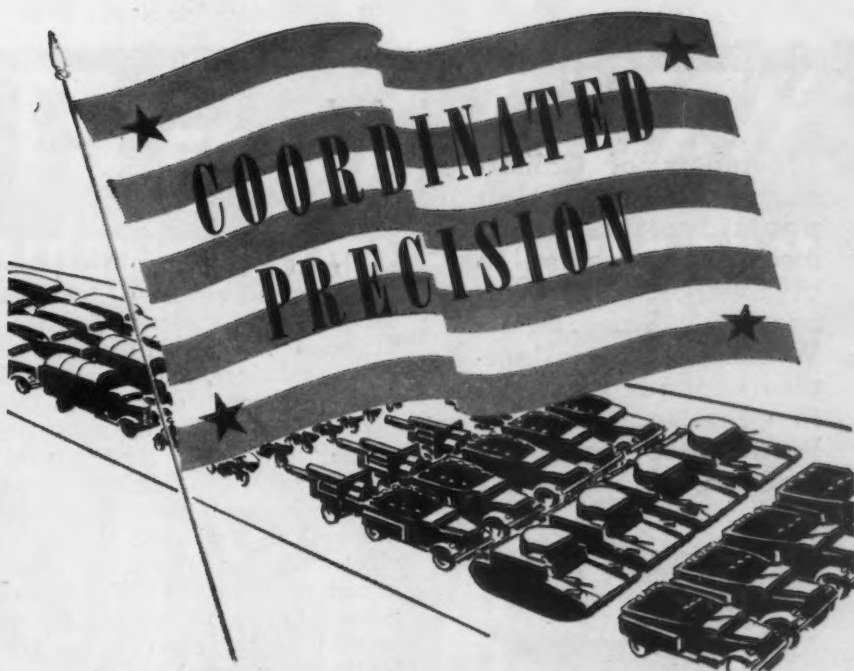
AP Photo

NEW WAGE-HOUR CHIEF: L. Metcalfe Walling, former administrator of the Public Contracts Division, was appointed Wage-Hour Administrator on Feb. 26. He succeeds Philip B. Fleming, recently appointed Federal Works Administrator.

ter of record for Congress because the board was a creature of Congress and was only discharging its duties under the law.

The hearing ostensibly was held to determine the prevailing minimum wages in the industry but actually it centered around wage differentials which the industry wanted maintained in the seven districts which exist.

The AFL Bridge Workers Union reported existing wages in 5c. differential groups, disregarding the industry's regional classification. They argued for a flat wage for the whole country. The higher wage rates that organized labor seeks would principally affect "end of the line shops," scattered throughout the country, distant from the rolling mills. He said the labor proposal would further restrict the efficiency and consequently the employment in such shops, and also would reduce the number of competitors for government work.



The defense program of industrial production again emphasizes the critical need for a thoroughly reliable means of checking the lead of screw threads and rack teeth.

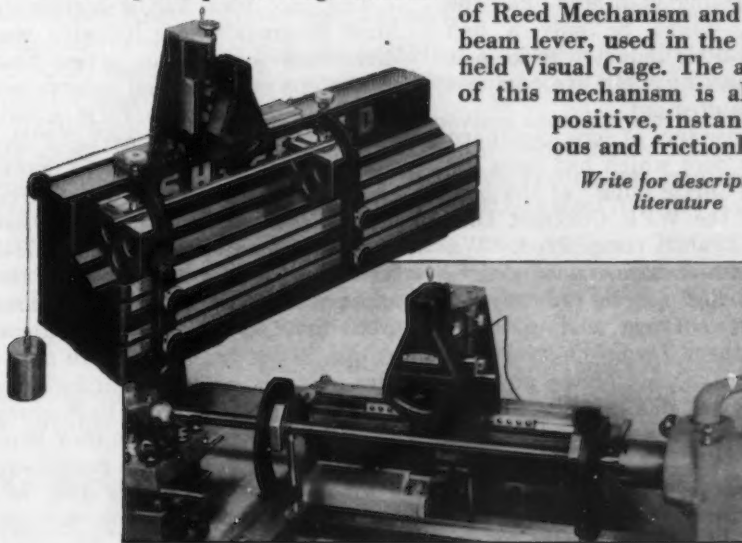
The Sheffield Thread Lead Checking Instrument is the ultimate in accuracy and speed—checking with precision gage blocks as the reference. And no special skill is needed, for anyone familiar with inspection procedure can handle this instrument.

There are two models, one for use on the bench, and a portable model which may be used on work still in the thread cutting machine, without removal.

The bench model handles screws up to 6" in diameter and 30" in length. The portable model handles screws from 1" to 4 1/2" in diameter or from 2" to 6". Twelve inches of screw is checked at one setting by either model. For screws longer than that more than one setting is made.

The principle of magnification is the well-known combination of Reed Mechanism and light beam lever, used in the Sheffield Visual Gage. The action of this mechanism is always positive, instantaneous and frictionless.

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WEST COAST . . .

• Members of California war production pools decry Government's indisposition to give work to small businesses . . . Kaiser's Far-Western industrial empire expands again in three directions . . . Removal of Japs demanded.



SAN FRANCISCO — New light on how small manufacturers are faring in the receipt of direct defense contracts through the organization of "pools" appeared last week at hearings of a committee of the California state senate.

Some testimony hinted that the pool idea might be only a fish thrown to little industry to keep it from squawking while its business life was snuffed out.

The secretary of one northern California pool which has been offered as a "prize pupil" of the pool section of the WPB Contract Distribution Branch complained, "We have given the government everything it asked for in the way of credentials, surveys and guarantees, but there seems no real disposition on the part of the government to give small business any work." A pool member said that "if no contract is obtained speedily we shall have to dissolve." This pool, a typical aggregation of 13 small industrial firms, at the time it was formed employed about 166 skilled employees and had an annual output of \$1,200,000 in civilian goods.

Hope apparently has been held out to small manufacturers that they can get into war manufacturing merely by forming pools and offering their collective services. This hope has been furthered by the

pool section of the WPB Contract Distribution Branch, which has encouraged the formation of at least 24 pools in northern California alone. Of these, the Contract Distribution Branch only claims that four have secured contracts. (One of the "successful" four is the pool whose complaint of lack of a contract is quoted above; evidently this pool is included on the list by virtue of minor subcontracts which it had when formed. The branch refuses to disclose the number or amount of the contracts secured by the other three).

THE head of the San Francisco pool section of the Contract Distribution Branch, the man charged with saving the fate of small industry via the pool route, is John H. Tolan, Jr., a graduate of St. Mary's College in 1933. Mr. Tolan is neither an engineer nor a member of the California Bar, but is the son of Congressman John H. Tolan of Oakland, Calif. Young Tolan has had experience, however, as the Congressman's secretary, and has an affable personality.

The pool idea had a legitimate birth in areas where industry was diversified to such an extent that operations of individual enterprises could be combined to form a balanced unit. In most parts of the country, however, individual enterprises have been settled in an area because it enabled them to best serve a common function. Best testimony to the truth of this is the appearance of entire blighted areas, as civilian industries shut down one by one. Thus the prospective members of pools are likely to be competitors, similarly tooled to produce similar products. Unless they happen to be able to handle a particular piece of war work, joining such factories can only intensify their misery, not salve it.

If factories individually refrain from seeking subcontracts for bits and pieces because jointly they are waiting for a prime contract, the war effort is being held back. If there is a possibility of their subsistence on essential civilian work, inaction of small fry in a pool may mean that some better equipped plant, which could be converted to

war work, is kept working on civilian products. (This might be true in the farm implement field). Finally, if a plant is unsuited for any type of war work whatsoever, the sooner its machines and workers can be diverted to plants which are suited, the quicker the war will be won. Pools must be formed around contracts, for contracts cannot be formed around pools.

HENRY J. KAISER'S far Western industrial empire expanded again last week in three directions. Steps taken to construct a large blast furnace in southern California, the first on the Coast, were smiled upon by the Reconstruction Finance Corp. At Vancouver, Wash., it seemed probable that the not-yet-completed Kaiser Co. shipyard, announced by the Maritime Commission in January and given a contract for 65 EC-2 cargo vessels, would be enlarged by one-third with more than a corresponding expansion of the ship contract. By this move eventual employment at the Vancouver yard would be raised to between 25,000 and 30,000 men. In northern California, plans were in the engineering stage and it was stated that within 90 days a plant would be completed in the Salinas area to calcine dolomite. This plant would be erected by the Defense Plant Corp. Several sources of dolomite are available in the Salinas vicinity, and the plant's product can serve as the basic material for the production of magnesium at the present Permanente plant. In this case, the Salinas raw material could either replace or supplement brucite hauled all the way from Nevada, or other temporary sources of deadburned magnesite. Otherwise, a complete new magnesium reduction plant could be based on the Salinas operation.

Because the Los Angeles Harbor shipyard of Bethlehem Steel Co. changed from the widely ballyhooed three eight-hour shift day to a two ten-hour shift day, 3500 employees last week walked off the job two hours before the end of each shift. The yard is building combat vessels for the Navy. The union contends that enough men are avail-

35 PLANTS *specify TOCCO* for Hardening Armor-Piercing Shot



Another vital Defense job for TOCCO Induction Heat-Treating



In U. S. A., Canada and England, more than 35 contractors have specified TOCCO Induction Heat-Treating for *speedy, high-quality* hardening of armor-piercing shot. Some of the advantages of this new, simplified electric hardening

process for this vital production assignment:

Minimizes rejects. No cracking problems. Split-second accuracy assures uniform results. Shot individually treated, eliminating risks of conventional batch treatment.

Doesn't require skilled labor. Simplified, automatic control permits use of girl operators,

conserving skilled labor for other Defense work.

Can be installed in assembly line because unit is clean, cool, compact (only 7 ft. x 5 ft. max.).

Matches production requirements. Makes possible outputs of hundreds, thousands or tens of thousands daily, depending on number of TOCCO units used and their size (20 to 125 K.W.).

For peace-time, too. 99% of TOCCO Jr. machines for Defense jobs are *standard*—adaptable to peace-time jobs by simply changing the work fixture.

Our production of TOCCO machines has been expanded 600% to meet vital defense demands. We're at your service!

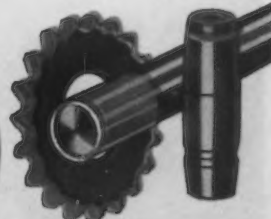
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able to work three complete eight-hour shifts, but San Francisco CIO representatives admitted that the company had had difficulty in getting enough supervisors. The two-shift day was inaugurated three weeks ago as an experiment to increase production, which has been successful, according to the company. The coastwide shipbuilding agreement applicable in other Pacific Coast yards provides a three-shift day seven days a week, and has been recently approved by labor, government, and employers.

AT the Puget Sound Navy yard, Bremerton, women are now being accepted for manual labor. Six have been hired as mechanic learners after passing civil service examinations. In the first war, scores of women drove trucks, operated power machines and did other manual work at the yard, but up until now only office work has been available to them. As mechanic learners, they receive 50 cents per hour with time and a half for overtime.

Draft board ruling that unskilled and semi-skilled defense industry employees without dependents will be subject to selective service is expected to raise the labor turnover in the aircraft industry considerably this year. The average age of aircraft workers is somewhat lower than in other industries. Employers have been warned that they

must look forward to turning out planes with many men not considered 100 per cent employable, or increasing the percentage of women workers. As a result, women are now working even in the final assembly line at some plants and in much more widely varied tasks than at first allotted to them.

Immediate construction of a black sand reduction plant at Sixes, Ore., has been announced by the Krome Corp. Electrolytic reduction will be used to obtain concentrates. The black sand is common north of Bandon and the Coquille River and at points south of Port Orford and in the Flores Lake region, in Oregon.

Scarcity of cast iron scrap in the Seattle region has finally forced the shutdown of two foundries there. The Morel Foundry and the Lake Union Foundry Co. have closed their doors.

Pacific Northwest aluminum production will soon reach 425,000,000 pounds annually, according to Paul J. Raver, Bonneville administrator. This, he declares, is three-fourths as much as the total for the entire nation before defense began to roll.

At San Francisco, James A. Folger, former coffee company executive, became district manager of priorities, succeeding Andrew M. Kerr, resigned.

Incited to action by an air-raid alarm in Los Angeles County and the bombardment of the Elwood

(Goleta) oil field by an enemy submarine, southern Californians last week demanded immediate evacuation of all Japanese aliens and citizens.

The drive to intern the Japanese was vigorously pushed by the news that about two dozen of them had been arrested during the air-raid alarm under suspicious circumstances. Many were reported flashing lights in signal patterns, while others refused to obey blackout rules.

A plan is under way to draft all Japanese, both aliens and citizens in an "agricultural division," to be placed in safe areas on suitable lands to raise food.

Seventy-three per cent of all Japanese in the United States are located in California.

War Production Pools Run Into Obstacles

Chicago

• • • Of 22 manufacturers' pools or groups in the Chicago ordnance district organized to get war orders, only one has received full clearance by the War Production Board and none has received a prime contract.

Undoubtedly this is the reason why the local branch of WPB has decided to stop aiding the formation of pools and to throw all its efforts in the direction of individual plant conversion to war production.

Several reasons are advanced for this change in attitude. According to the local WPB manager, factories seeking war orders will soon be in a sellers' market rather than a buyers'. Initiative will still be important, and small manufacturers should still seek out procurement offices and not wait for them to come to their door.

Among the reasons for failure of pools to obtain more orders, according to officials, are lack of facilities, high bids, lack of authority at the present time for ordnance officials to award contracts at prices over normal competitive levels, a general "the government-owes-us-a-living" attitude, and lack of initiative and ingenuity in adapting plants to war work.

WEIGH STEEL CHECKOFF: Richard T. Frankenstein, director of aircraft organization of the UAW; Arthur S. Meyer, chairman of the committee; and Cyrus Ching, vice-president of U. S. Rubber Co., have been appointed as a special investigating panel of the War Labor Board. Meeting for the first time on Feb. 26, the panel discussed the procedure of the forthcoming hearings into the dispute expected to bring a showdown on closed shop and general wage issues between Little Steel and the C.I.O.

Acme News Photo



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THREAD ROLLING



DIE INSPECTION



METALLURGICAL CONTROL



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HEAT TREATING



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A well manned technical staff of competent metallurgists and experienced production, research and field engineers.

The seasoned production experience of our personnel combined with the use of modern equipment and methods is your assurance that our organization can take the tough jobs at the embryonic stage, handle them completely, quickly and capably, and deliver a product of highest commercial standards.

Quotations can be furnished from blueprints or one of our field engineers will gladly call for personal discussion.

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Fatigue Cracks

BY A. H. DIX . . .

90 Proof: 90 Days

• • • *Sales Management* had a hunch that manufacturers are taking too much for granted in assuming that the general public knows what is meant by AC-DC, F.O.B., I.E.S., 90 proof, 6.00-16, and other abbreviations used in advertising. So it had a corps of investigators call on housewives and ask for definitions.

Only one-third knew the meaning of AC-DC. To one woman it meant "one is electric current while the other comes from batteries." The correct definition of F.O.B. (free on board) was given by only one-third. One answer was "It means Federal Office of Better Business." Not a single housewife knew that I.E.S. stands for "Illuminating Engineering Society." To some FM meant "free movement," 6.00-16 meant "guaranteed for 6000 miles and only 6.00 per cent good," and 90 proof meant "aged 90 days."

We ourselves had always wondered what "I.E.S." stood for, and sometime when we get around to it we will make up a list of abbreviations used in your favorite family journal and ask a couple of hundred readers what they mean. We will include such terms as 18-8, CAA, SWOC, f.a.s., p.s.i., c.i.f., D.P.C., and I.C.

We know that 18-8 stands for the percentages of nickel and chromium in one grade of stainless steel, but we can never remember which is which, and f.a.s. means no more to us than PD-1A means to a Patagonian.

Mythical Railroad

• • • *Deac* says that for months after he got his first job he thought the country's biggest railroad was the B. & C., as so many orders came in marked "Ship B. & C., meaning, as he discovered later, "Best and Cheapest."

Our Cross

• • • Speaking of the Priority Division's new form PD-1A, C. Adrian Gabig of the Brainard Steel Co. says he will sic Leon Henderson on our trail for charging 15c. a set, so we hurriedly settled for 5c. a set. A set consists of four sheets—original, duplicate, triplicate, and instruction sheet. Do you need any?

We never know quite what to do about the PD forms. When a new one comes out we usually get a couple of telegrams from people who want a supply in a hurry. So if it is a reproducible form we accommodatingly print it, guessing how many we should print and how much we should charge to break even.

So far our guessing has been pretty bad, for we find that people call on us only when the form is brand new and before the established sources of supply, the stationery stores and printers, have laid in a supply. Most of the time we guess wrong on the high side, but in the case of the much used PD-73 we were 'way off on the low side and had to put it back on the press more than a half dozen times.

We have printed an emergency supply of the new PD-298 and PD-299 that steel plate consumers have to fill out. The price of each is \$1 a hundred. We also hope we can get rid of PD-1A at 5c. a set.

Letdown by Godown

• • • All our life so far we have been wondering what a "godown" is. The term is used frequently in descriptions of the Far East. A recent issue of *THE IRON AGE* says it is simply a local word for warehouse. If this is all it is, all we can say is that we are greatly disappointed.

Maybe some traveled member of this page's loyal army of eighteen readers can tell us how anything so prosaic as a warehouse came to get such a graphic name.

Every Knock Is a Boost

• • • Gene Tunney's blast against cigarette smoking, in the December *Reader's Digest*, alarmed us so much that we swore off for a time. And being a firm believer in the Power of the Press we made a note to watch cigarette sales.

The Internal Revenue Bureau's figures for January are now out and we are dismayed to find that production for that month was 19½ billion cigarettes, an all-time high. If you are a stickler for exactness, the exact figure was 19,502,624,610. The four cartons we didn't buy in January don't seem to have made much difference, so we are in there again helping inhale it up to an even 20 billion.

Bird's-Eye View

• • • Although the year still has ten months to go, we have already picked the winner in the 1942 names-that-sound-like-the-job contest. He is an authority on aerial photographic mapping, who recently joined the H. K. Ferguson Co., Cleveland. His name is Sidney H. Birds-eye.

We Plead Innocence

• • • To test the speed of advertisers' response, we went through a copy of the *Saturday Evening Post* some years ago and wrote for every piece of literature or sample of goods offered free. As we recall it, only about one-eighth answered within the first two weeks; about half responded during the next several months, and the remainder didn't bother to reply at all. With a few notable exceptions, the responses gave the impression that we were a nuisance.

We bring this up because it has to do with a problem of our own. As you know, we frequently run a blue page headed "Free Literature." On a postcard at the foot of the page you ring the numbers of the catalogs or bulletins that you want and you mail the card to us.

The trouble is this: sometimes the literature is received late, and sometimes it is never received. If this, heaven forbid, should happen to you, you would be unjust if you blamed us, for your f.f.j. is as innocent as a n.b.b. We do not stock the literature here. We simply forward inquiries promptly to the manufacturer offering it. Our function is simply that of a middleman. But if you don't get what you ask for, we would be glad if you would let us know.

P-s-s-s, Missy LeHand

• • • Maybe somebody can find a diplomatic way to tip off the President to the fact that *decadent* is pronounced de-kay'-dent, not deck'-a-dent.

Grammatical Headwinds

• • • The brains department's Bill Phair, who occupies the cell next door, says he never bothers to unscramble the meaning of a sentence with more than two negatives, as, for example, "This does not mean that there are not times when a contrary situation does not prevail." The only way to find out what a sentence like that means is to cancel out the negatives as you would the y's in an equation.

Speaking of phrases that give a ratiocinative sweat here is one uttered by Dr. M. G. de Chazeau during the TNEC hearing on iron and steel price policies:

It (steelmaking cost) changes in a stable way, namely, that the variable cost is a constant and varies with the output.

Problems

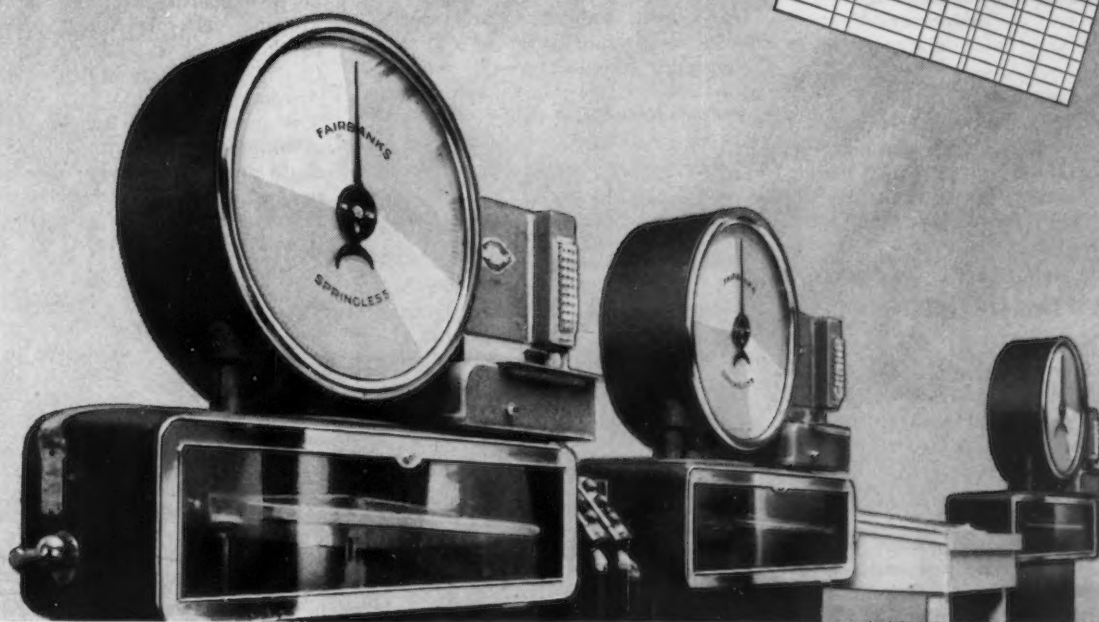
• • • Last week's skeleton is fleshed thus:
625) 631938 (1011.1008

Five minutes is par for this:

A cylindrical glass is 4 in. high and 6 in. in circumference. On the inside of the glass, 1 in. from the top, is a drop of honey, and on the opposite side of the glass, 1 in. from the bottom, on the outside, is a fly. How far must the fly walk to reach the honey?

Scales that see

... and keep books!



IT costs money to be inaccurate with "tonnage"—and it costs more money to be s-l-o-w.

In one of the most modern coal preparation plants in the world, Elkhorn Coal Company, Wayland, Ky., you will find a battery of the most modern scales handling "tonnage" at high speed.

These Fairbanks Scales with "electric eyes" shut off flow to hoppers automatically when the pre-set weight is obtained. A printed record is made of each operation automatically, and an ingenious keying system credits the tonnage to the man who mined it.

To make errors in weighing well-nigh impossible, to fit weighing speedily into the production flow, to protect alike the buyer, seller, and all whom weighing affects is the aim of this, the most experienced and most modern organization of scale makers.

There are Fairbanks Scales in types for your every weighing need . . . and Fairbanks Scale Engineers are available at your call.

Fairbanks, Morse & Co., Dept. A-38, 600 S. Michigan Ave., Chicago, Illinois. Branches and service stations throughout the United States and Canada.

We Want To Help You

It is our desire to do everything we can to aid in the speed-up of American production. Our scale engineers can possibly suggest new and more efficient use of your present scales or modification which will expand their capacity.

FAIRBANKS · MORSE SCALES

DIESEL ENGINES ELECTRICAL MACHINERY RAILROAD EQUIPMENT WASHERS-IRONERS STOKERS
PUMPS MOTORS WATER SYSTEMS FARM EQUIPMENT AIR CONDITIONERS

Dear Editor:

RESIDUAL NICKEL STOCKS

Sir:

My product is not covered by a priority. I do my own nickel-plating. Will I be permitted to use up my remaining stocks of nickel after Apr. 1? If not, what can I do with the nickel?

W. H. L.

• WPB Order M-6-b forbids the use of nickel, after Apr. 1, for articles not on the exempt list. You will not be permitted to consume your remaining stocks of nickel or nickel salts. As this is written, WPB has issued no ruling concerning disposition of residual stocks but we understand that the matter is now being discussed in Washington.

Reprints of the four-part series by Adolph Bregman on silver plate as a substitute for nickel and chrome plate are available at 25c. Write to THE IRON AGE, Reader Service Dept., 100 E. 42nd St., New York.—Ed.

SCRAP SHORTAGE REMEDY

Sir:

By using the following plan and the scrap gathering agencies now in existence the flow of material into the steel mills would be adequate for quite some time.

1. Any title to a complete old or wrecked car when presented to the place from which license plates are usually sold to be paid for with a \$18.75 United States government bond. No restrictions. Dealers or individuals.

2. Automobile wreckers upon presentation of a receipt from an authorized scrap dealer for one thousand pounds of scrap (steel, cast iron, copper, brass, aluminum, etc.) and \$3.75 in cash to one title in the order in which they were received. Cars to be picked up by the wrecker.

3. The balance of \$15 to be made up by a \$10 contribution; pro rated among the automobile manufacturers as of 1940 new car United States registrations. Plus \$5 of United States emergency funds.

4. The state Secretary of State office to provide investigators (with broad emergency powers) to check and pass cars without titles; out of state titles, cars belonging to estates and those of deceased persons.

The large amount of labor involved and the time necessary to clear up titles make the wrecking of cars for scrap unattractive at this or any other time.

I have very good reasons for believing this plan would bring in fifteen million tons of scrap metal. The attractiveness of the plan should be apparent to the manufacturer (pro

rating their costs would be comparatively small considering the benefits) public safety clubs, insurance companies, press and radio. In short every automobile with a wholesale value of less than \$18.75 would be off the highways. Retail this would be approximately \$50.

LESLIE WATSON—No. 49333

4000 Cooper St.,
Jackson, Mich.

ARMOR-PIERCING SHOT

Sir:

Have you published any recent articles on the fabrication of a 20 mm. shot, armor piercing type? Any information you can give us on the manufacture of the above material will be greatly appreciated.

THOMAS & SKINNER STEEL
PRODUCTS CO.

Indianapolis, Ind.

• Nothing has been published in THE IRON AGE on this subject, as data are restricted by the War Department. Our understanding is that this small shot is machined from bar stock on automatic screw machines by hollow milling. We suggest that you communicate with automatic screw machine builders.—Ed.

PRODUCTION CONTROL

Sir:

We should like to make copies of an article which appeared in THE IRON AGE available to a group of men who are now studying problems of defense production here. The article is "How to Control and Plan Production," by G. V. Black and appeared on pages 34-37 of the July 11, 1940, issue.

LYNN L. BOLLINGER,

Business Administration
Harvard University
Boston, Mass.

• Granted—Ed.

COOK AND GLAMOR GIRL

Sir:

I will be very pleased to receive a copy of the Editorial "The Cook and the Glamor Girl" which I understand you have had reprinted.

Your splendid publication is read with interest regularly by many members of this organization.

W. W. SLOCUM,

Lieut., Comdr., USNR

Navy Department
Office of Inspector of Naval Materiel
Pittsburgh District

AUSTRALIAN SCRAP

Sir:

There is a considerable quantity of scrap steel accumulated in Australia in the various shipping ports and we feel fairly certain that the Australian government would allow this to be shipped to the United States in view of the joint efforts being made in this present war by our two Governments.

The two big steel works in Australia are producing pig iron so cheaply that they are only open to take limited quantities of scrap. We would be in a position to ship No. 1 Heavy Melting, No. 1 Heavy Compressed black sheets, No. 2 Heavy Melting, Cast Iron Borings in drums and Clean Automobile Scrap.

A certain amount of freight is available to San Francisco and if you could put us in touch with a reputable firm of scrap steel merchants in San Francisco or other West Coast ports, it would be appreciated.

A. S. DICKSON,
Governing Director

Dickson Primer & Co. Pty., Ltd.
73 Dey Street
Sydney, Australia

BEARING ALLOY

Sir:

A misstatement is made on your Feb. 19 "Dear Editor" page in answering Walter F. Grove's question regarding a low melting alloy for use in holding bearings in place as described in the article, "Simplified Shell Lathe," published in your Mar. 6, 1941, issue.

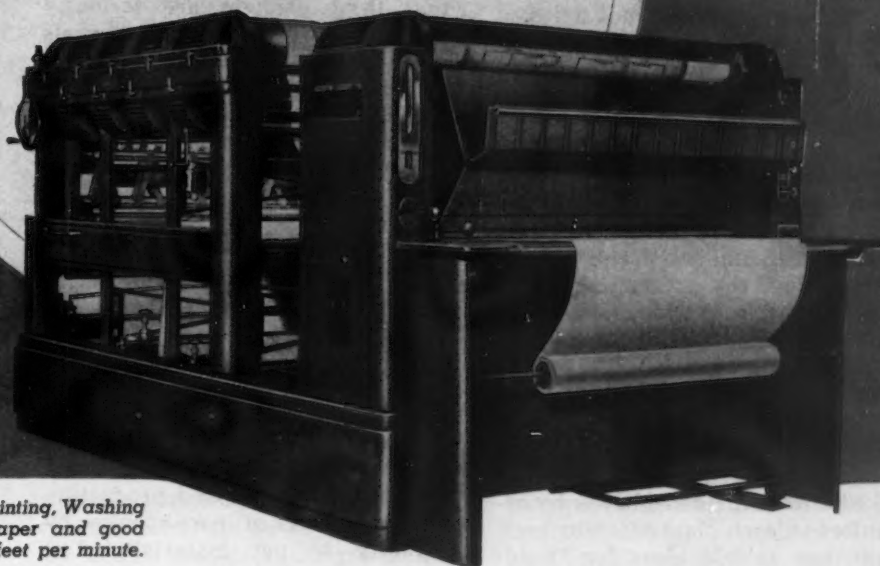
When the lathes were first designed, Cerromatrix, an alloy of bismuth, lead, tin and antimony was considered, because it is successfully used for similar applications of holding die and machine parts accurately and permanently in place. The conditions to be met in the shell lathes, however, made it necessary to develop a special alloy containing bismuth, lead and tin, which is known as our No. 3333-1 alloy. This metal is more fluid in the molten state than Cerromatrix and although not quite as hard, it has sufficient compressive strength to meet the requirements. The hardness is sacrificed to obtain greater fluidity, because the openings in the frame of the lathe, into which the alloy is poured, are in most cases quite remote from the bearings around which the alloy must be cast. Preheating the frame of the lathe is not practicable.

J. D. TRETHAWAY

Cerro De Pasco Copper Corp.
40 Wall St.,
New York City

TIME...

The most valuable thing in your plant...
Save it with BLUEPRINTS at 30 feet per minute



Pease Model "22" Continuous Blueprinting, Washing and Drying Machine using fast paper and good tracings produces Blueprints at 30 feet per minute.

War taxes men and machines to capacity to provide our armed forces and our allies with the supplies they need for victory... Time is all-important—it must be used wisely and well.

Pease Continuous Blueprinting Machines meet every challenge... operate faster, more economically... require less attention... deliver a greater volume of Blueprints.

...and too, time is saved in the drafting room for clear, contrasty Blueprints can be made from pencil drawings without inking in.

THE C. F. PEASE COMPANY
 2695 WEST IRVING PARK ROAD • CHICAGO, ILLINOIS

These Advanced Features Simplify Production

- ★ Sliding "Vacuum-like" Contact smooths out tracings.
- ★ Three Speed Lamp Control operated at 10, 15 or 20 amperes.
- ★ Actinic "No-Break" Arc Lamps give unusual uniformity of light.
- ★ Horizontal Water Wash free from tension—prevents wrinkles.
- ★ Quick Change Chemical Applicator System for Blueprints or Negative prints.
- ★ Eight-inch Drying Drums heated by gas or electricity.

Blueprinting Machines

A TYPE AND SIZE FOR EVERY REQUIREMENT
 INCLUDING DIRECT PROCESS PRINTING

This Industrial Week . . .

• • •

U.S. industry this week was following the suggestion of Donald M. Nelson, War Production Board chairman, that it set up scoreboards for workers, for managers, for departments, for plants and for whole industries.

"We Americans love competition," said Mr. Nelson, "the matching of wills and skills in sport and trade. Here in this plan we have in effect the greatest competition of all time in which the wills and skills of American industry—men and management—can really make freedom ring around the world."

To bring the production goals closer to men and management, Nelson is assigning quotas to primary war producers. That each man in industry may measure his accomplishments visually, Nelson has requested that production scoreboards be erected in every shop. He asked that joint committees be organized in each plant whereby each man may submit ideas for "welding our productive genius into a united effort for victory."

Worker Holds Key To Nation's Fate

The stake in the war production is, Nelson indicated, considerable. He said: "On the way he (the workman) does his job depends the fate of all of us, the fate of our soldiers, sailors and airmen, of our families and friends. Upon the way that job is done rests all our hopes for future years."

Meanwhile the bulk of American industry continued to have conversion pains and the inevitable creaking and groaning could be heard in many places. Accompanying the War Board leader's production speech, first of a weekly series, was a sharp increase in the issuance of "L" or limitation orders curtailing production of non-essential goods. The latest of such orders have been directed against the makers of refrigerators, laundry equipment, firearms, musical instruments, small planes and certain types of track-

laying tractors. Use of critical materials has been restricted in civilian types of fire protective equipment. Another phase of the conservation program is that of simplification of designs.

While many of the larger plants have swung into war goods production with a speed which is evidence of the advantages of size, or resources and of skilled management, a number of smaller plants recently have been complaining about the constant changing of priority regulations and procedure. They report that these changes are seriously hampering the flow of materials into their plants, now on war work. Against Mr. Nelson's statement output can be increased 25 per cent with existing equipment, some plant managers report that confusion over priorities is actually slowing production.

Complaints Rise In New England

Among the important industrial areas where complaints about the working of the priority system have multiplied in the past 10 days is New England where the full six-day week is not yet universal and where efforts to expand production have been checked in many cases by inability to get materials. The problem of eliminating the steady flow of changes in priority regulations is complicated by the fact that

many revisions reflect efforts of the WPB to correct inequalities in the original form of the approximately 200 orders.

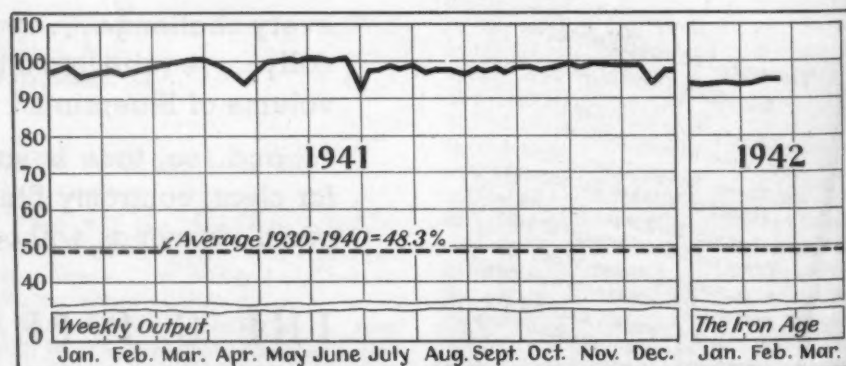
Priorities unemployment in the state of Pennsylvania has taken away the jobs of 28,815 workers and has shortened working hours of another 40,000, according to the state's employment service. In some plants, however, conversion to war implement manufacture has proceeded so rapidly that more workers have jobs than in peacetime. A leading steel company reports that 2.8 per cent of its employees have been drafted or have voluntarily enlisted in the armed forces while an additional 2.2 per cent have been called but are temporarily deferred.

High on the list of headaches to the planners for sharply increased war goods production is the steel wage increase case, now in the hands of a War Labor Board panel. If the \$1 a day pay increase, or part of it, is allowed by the board, wages in many other industries may be lifted. When the large steel companies grant wage concessions, the smaller fabricators are forced to meet the advance, or lose their labor to the steel mills. In turn, the neighboring plants of small fabricators and concerns operating closely with them, must give similar wage increases.

One result of this spiralling of

Steel Ingot Production—Per Cent of Capacity

(Open Hearth, Bessemer and Electric Ingots)



Steel Ingot Production, by Districts—Per Cent of Capacity

	Pittsburgh	Chicago	Youngstown	Philadelphia	Cleveland	Buffalo	Wheeling	Detroit	South	South Ohio	West	St. Louis	East	National
This Week.....	97.0	103.5	99.0	91.0	92.0	92.5	91.0	94.0	99.0	99.0	95.0	80.0	98.0	96.5
Last Week.....	97.0	101.0	97.0*	91.0	94.0	90.0	91.0	94.0	99.0	99.0	95.0	81.0	103.0	95.5

* Revised

wages will be appeals by marginal companies to the OPA for relief from price ceilings. Since the OPA evidently has expected that steel prices will not be increased above the present fixed levels, it must prepare for a flood of such appeals if steel wages are lifted.

Empire Sheet & Tin Plate Co., Mansfield, Ohio, has been granted an exemption of \$5 a ton on sheet bar and \$2 a ton on ingots by OPA, permitting the company to sell sheet bar at \$39 and ingots at \$33. This step was taken under the provision of the price control act authorizing sales above ceiling prices when an OPA examination of earnings and costs justifies such action.

From Toronto comes word that the wartime prices and trades board of the Dominion of Canada has authorized an increase of prices on some steel products by \$5 a ton. Under the new price revision, carbon and alloy bars, structural shapes, sheet piling, black sheets and track fastenings are advanced 25c. a hundred pounds. Prices of forgings and light rails have been lifted \$5 a ton and heavy rails \$5 a ton.

February Orders Close to January

February ended with the volume of incoming steel orders averaging close to January totals, and more companies reporting increases than decreases in bookings despite the tremendous rated steel backlog now held by the industry. Concentration of steel orders for direct war use is continuing at an accelerated rate and actual steel shipments in the past few weeks ranged from 65 to 75 per cent on orders carrying an A-3 rating or better. Out-right allocations have been increasing. Each week brings an upward revision in estimated steel requirements for ships, shells, tanks, trucks and bombs.

The Maritime Commission's next 770 "Liberty" ships, for which no material has been ordered, will be built 80-90 per cent from plates which are no wider than 90 in., generally no wider than 72 in., with the material coming from converted strip mills formerly shipping to automotive plants. The plan will not free plates for civilian use but will make possible the fulfillment of essential war orders. The report that railroad car builders may soon begin construction of wood cars to



BOMB DISPLAY: Behind Captain John F. Foy, chief instructor in an officers class in the Aviation Ordnance section are types of some of the various projectiles used in the present war.

overcome the plate shortage is believed by some observers to be paving the way for wider use of wood in other types of construction work. Some defense plants, particularly those unlikely to be used after the war, may be built of wood.

Demand for tin plate for production of primary product cans used to pack vegetables and fruit is expected to be so great before the packing season closes that the allowable limits on secondary and special cans will never be reached. It is also expected that production of uncoated black plate, except on priority rated business, will soon be eliminated altogether. Steel makers look for an order restricting production of black plate for certain types of cans.

Unrated Tonnage To Be Byproduct

Within the next month it is expected that steel shipments will represent 90 to 95 per cent rated tonnage and that any unrated business will represent merely by-products of tight rolling mill schedules. It is also expected the government, through the War Production Board, will exercise much closer control over shipments of steel in the various priority levels. Steel companies have already been told that recent shipments have been running too heavy in lower rated classifications and in non-rated categories. This reminder may be a forerunner of more drastic control over total steel distribution.

Steel ingot output this week reached a new high mark with the

mills operating at 96.5 per cent. This represents a gain of one point over the preceding week and, when converted to the capacity ratings prevailing in the last half of 1941, is about one point above the 1941 high of 98 per cent reported in the first week of November. Among the largest districts reporting increases this week are Chicago, which rose 2½ points to 103½ per cent, Youngstown up two points from last week's revised rate to 92.5 per cent. Pittsburgh is unchanged this week at 97 per cent as are Philadelphia at 91 per cent, Wheeling at 91 per cent, Birmingham at 99 per cent and Detroit at 94 per cent. The only large district to show a drop is Cleveland, which lost two points to 92 per cent. The Eastern District lost five points to 98 per cent.

A stronger flow of scrap in major steel-producing areas enabled the steel industry to strengthen its operating schedules temporarily but new obstacles threaten to darken the scrap outlook. The nationwide roundup of automobile graveyard scrap, which had been expected to liquidate such yards within three months, has run into a stumbling block in the form of lack of "burners" who cut up the metal. The shortage of freight cars is becoming more pronounced. In some parts of the country the weather was unfavorable at the week's start, with a sudden and severe snow storm around Pittsburgh slowing up production in one area. Heavy snows downed power lines and hampered bar and pipe mill operations at two plants.

CONTROLLED QUALITY JUNIOR BEAMS

Strong—economical—light-weight steel I-Beams for reducing dead load in floors and roofs of factories, hangars, cantonment buildings, housing projects and other light-occupancy structures.



J&L STEEL

JONES & LAUGHLIN STEEL CORPORATION
AMERICAN IRON AND STEEL WORKS • PITTSBURGH, PENNSYLVANIA

News of Industry

4 S.A. Countries Found Suitable for Steel Production

••• Four South American countries can establish their own steel industries at a considerable cost but the remaining countries of that continent are not good prospects for the building of steel plants, H. W. Graham, director of metallurgy and research, Jones & Laughlin Steel Corp., says. In a report to the National Research Council following a tour of South America, the J. & L. metallurgist also discusses South American nations as markets for steel made in the U. S. and as sources of raw materials.

Brazil, Mr. Graham notes, with financial help from the United States, is now building a plant at Volta Redondo. Ore deposits are large, but vary greatly in quality and are in some instances inaccessible. Low grade coal, 15 to 35 per cent ash, is obtainable, but supplies will have to be imported. The new plant will use open hearth methods and have an output of 300,000 to 450,000 tons of steel a year. Scrap is scarce, hence it may prove necessary to use other steel making processes.

Chile, now a small producer, is planning an electro-metallurgical plant at Puerto Montt. To obtain necessary ore, a railroad and a dock are being built in the northern part of the country, near Coquimbo. Ore there is plentiful and of good quality, and can be delivered for about \$2.00 per ton to the plant. Charcoal, obtained from the forests near Puerto Montt, will be used to produce the carbon needed for this process, while limestone is also plentiful in



AP Photo

BRAZILIAN PLANE ENGINES: Representatives of the Brazilian government and the Wright Aeronautical Corp., recently signed an agreement whereby Brazil will build airplane engines under Wright license. Here are representatives of the Brazilian government and Wright representatives signing the agreement at Paterson, N. J., on Feb. 23.

the northern part of the country. Power is plentiful and cheap. Chile plans to use the same type of electric blast furnaces as are used on a small scale in Norway and Sweden. Cost of iron produced by this method is expected to be \$6.00 a ton, exclusive of financing and overhead charges.

The Puerto Montt plant is expected to produce 150,000 tons of steel per year, and will have facilities to roll bars, plates, etc. The cost of this venture is estimated at \$20,000,000. Later, Chile may use the cheap power from the many fiords to produce ferro-manganese, which commands a good price throughout the world.

Peru has no steel production now, but U. S. engineers reported to the Peruvian government on the possibility of a modest plant based on the consumption of Peru's anthracite coal resources, which are believed to be rather good. Peruvian officials are now considering the prospect of such a development.

Colombia is believed to have the best coal resources in South America, with ash content running about 10 per cent. Some of this could be used for metallurgical coke production, but transportation of this material is a problem.

Colombia has no steel capacity at present, but local interests are trying to promote the construction of an electric furnace plant based on the melting of scrap. This plant would have an annual capacity of about 5000 tons per year.

Other Latin American countries are not good prospects for development of iron and steel plants. Venezuela, like Colombia, has some good ore and coal resources. Argentina, Uruguay, and Paraguay are out of the picture completely, while Bolivia, with some coal and iron resources, faces a very difficult transportation problem.

South America could, and to some extent does, export iron and manganese ores to American steel plants along the seaboards, Mr. Graham says. However, domestic ore sources are more favorable to inland American plants. While there are considerable deposits of tin, molybdenum, vanadium, tungsten, and beryllium in South America, except for the tin, optimism of trade on these commodities with United States is not justified as this country is rapidly developing domestic sources of these ores.

As to South America being a market for United States made steel, high labor costs in this coun-

try put it at a disadvantage in competition with European manufacturers. Better quality plus metallurgical and technical service, such as is given in domestic trade, may help extend American markets in South America. Mr. Graham points out, however, the purchasing power in South America is limited and controlled by a small minority, a problem that must be considered for successful entry into South America markets.

Galvanizers Told of WPB Contract Efforts

Pittsburgh

••• Government agencies are concentrating exclusively on the finding and utilization of existing equipment and facilities to carry on the war effort before embarking on any new expansion programs, C. A. Woodruff, WPB contract distribution official, told

members of the American Hot Dip Galvanizers Association, Inc., here last week at the annual meeting.

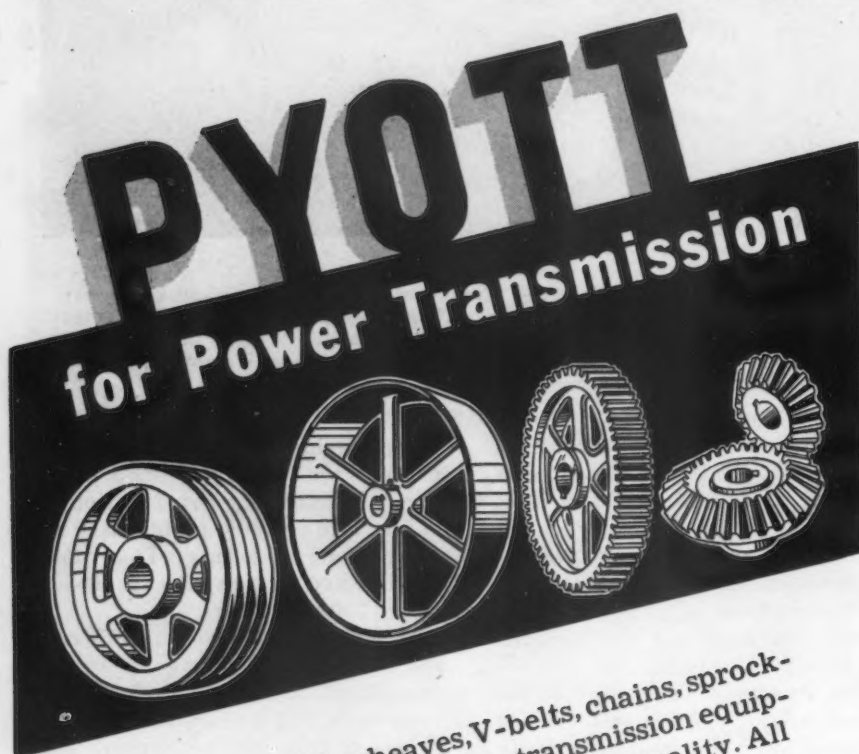
Mr. Woodruff said all successful bids on contracts are scrutinized closely and with the help of the 135 field offices of the contract division, every effort is made to discover existing machinery and equipment needed to complete such a contract. The speaker admitted that in the past there had been cases where galvanizing equipment was purchased and put into operation when existing facilities were already available but he insisted that this era was over and that urgent demands as well as conservation of the taxpayers' money pointed to no expansions of any type unless absolutely required.

Commenting on the excellent cooperation within industry on problems arising out of production of war contracts, the speaker said that some companies have gone to unusually great lengths to make available blueprints, technique, and even foreman training for other companies about to start into production on the same type of military items.

Stuart J. Swensson, secretary of the Association, announced that the Thomas M. Gregory memorial award had been established by the board of directors to be presented for outstanding achievements in the industry by any of its members.

New officers elected for the association are as follows: President, Phelps Ingersoll, president, Wilcox, Crittenden & Co., Inc., Middletown, Conn.; first vice-president, Clem Stein, International-Stacey Corp., Columbus, Ohio; second vice-president, J. B. Tate, Witt Cornice Co., Cincinnati, Ohio; secretary-treasurer, Stuart J. Swensson, American Bank Bldg., Pittsburgh; W. G. Imhoff was reappointed technical director of research.

The board of directors is as follows: Phelps Ingersoll; Clem Stein; J. B. Tate; I. M. Herrmann, president, Acme Galvanizing, Inc., Milwaukee; A. J. Blaeser, vice-president, Joslyn Mfg. & Supply Co., Chicago; W. J. Gregory, president, Thomas Gregory Galvanizing Works, Maspeth, N. Y.; F. P. Auxer, president, National Telephone Supply Co., Cleveland.



Pulleys, flywheels, sheaves, V-belts, chains, sprocket wheels, gears—Pyott power transmission equipment is a complete line of the highest quality. All round castings are perfectly finished and balanced for smooth operation at high speeds. Matched sets of V-belts, for drives up to 500 H.P. Pyott stock pattern equipment saves you the pattern cost on pulleys and flywheels of all designs, in diameters up to 12 feet, and sheaves to 9 feet in diameter. Pyott's advanced manufacturing methods mean quicker delivery and better service. Call on Pyott for power transmission.

PYOTT FOUNDRY & MACHINE CO.
328 NORTH SANGAMON STREET
CHICAGO

Carnegie-Illinois Revises Aircraft Alloy Steel Charts

••• The sales promotion department of Carnegie-Illinois Steel Corp. has made several revisions in the tables listing and correlating government specifications for aircraft alloy and stainless steels, which tables recently appeared in a booklet published by that company and were reproduced in THE IRON AGE, Feb. 19, pp. 62-65. Reprints of these corrected tables are obtainable from THE IRON AGE. As originally published, credit for preparing these tables was incorrectly given to the market research department of Carnegie-Illinois rather than to the sales promotion department.

Stacks Being Relined In Record Time

Pittsburgh

••• Many record breaking achievements have been reported recently in the blast furnace industry. Not only are workmen within the individual companies striving to better records already made, but other companies are straining every effort to surpass their competitors, all of which is resulting in increased pig iron production over and above what was thought possible with existing facilities a year ago. The urgent need for pig iron is so great that amounts as small as 200 or 300 tons can be used today and produce an economic benefit which might be ten times as great as if it were available a year from now.

Latest company to join the procession is Jones & Laughlin Steel Corp. which reports that one of its blast furnaces has made 3,205,916 net tons of pig iron on a single lining without repairs or patching and this company has gone a step farther by changing the number of the furnace which will henceforth be called "the war furnace." Relining on this particular unit was finished in the record time of 24 days and according to the company the war furnace is now after a new record. Other records claimed recently on production or repair include a Carnegie-Illinois furnace in the Pittsburgh district, a Columbia Steel furnace on the West Coast and the Globe Iron Co. stack in Ohio.

ROEBLING Wires

ROUND • FLAT • SHAPED



HIGH CARBON ROUND STEEL WIRE AS SUPPLIED TO THE BOBBIN MANUFACTURER

BOBBIN SPOOL WITH SNAP RINGS IN PLACE AFTER FORMING AND TEMPERING

BOBBIN RING WIRE—

that holds a *uniform* shape and tension



ROUND HIGH AND LOW CARBON COMMON AND SPECIALTY WIRES

Hard Drawn, Soft Annealed or Tempered, in all Finishes—Bright, liquor Finish, Coppered, Tinned, Galvanized.



FLAT HIGH AND LOW CARBON AND SPECIALTY WIRES

Hard Rolled, Annealed, Scaleless Tempered; Tempered and Polished, Tempered, Polished and Colored; Various Finishes—Bright, Tinned, Coppered, Hot or Electro Galvanized.

SHAPED WIRES

Various High or Low Carbon Shaped Wires such as: Shaft Casing Wires, I Beam Sections, Space Block Wires, Square, Keystone, Oval, Half Oval, Half Round, etc.

Snap rings for the base of textile bobbins must fit snugly around the grooves as well as hold a uniform tension. That calls for exacting specifications in the Roebling high carbon steel wire from which they are made.

Dimensional accuracy and quality must be held within very close limits...since the wire must respond *uniformly* to heat treatment after forming. Only in that way can high speed production be maintained, rejects cut to a minimum.

Making high quality steel wire within close limits is a specialty with Roebling. We have the kind of steel-making facilities and the highly-trained organization that has provided the answer to hundreds of such difficult problems.



JOHN A. ROEBLING'S SONS COMPANY

TRENTON, NEW JERSEY • Branches and Warehouses in Principal Cities

Boegehold, Galvin, Dwyer And Allen Honored by A.F.A.

Chicago

• • • A. L. Boegehold, J. E. Galvin, Pat Dwyer and R. M. Allen have been cited by the board of awards of the American Foundrymen's Association for outstanding service to the foundry industry and will be presented with medals

and life memberships at the association's annual convention in Cleveland, April 20 to 24.

Boegehold, chief metallurgist of General Motors Research Laboratories, Detroit, will be awarded the J. H. Whiting gold medal, while Galvin, who is president of the Ohio Steel Foundry Co., Lima, O., will receive the John A. Penton gold medal.

University of Detroit Plans Engineering Forum March 14

• • • Four engineering discussions of current problems will be features of the annual University of Detroit engineering alumni conference, March 14, at the U. of D. campus, Detroit.

"Illumination of Defense Plants" will be presented by L. E. Taylor, of Detroit Edison Co. "The Aircraft Tooling Problem" will be discussed by Llewellyn Hautau of Empire Engineering Co. The utilization of every production facility as well as the application of all available old and new materials will be discussed in the paper "Substitute Materials and Alternate Methods" by William F. Sherman of the Class of 1934, Detroit editor for THE IRON AGE. Dean Clement J. Freund, will discuss "The Engineer in the War and After."

Ornamental Metal Groups Convene and Name Officers

Cincinnati

• • • At the joint convention here, Feb. 20 and 21, of the three national associations of Ornamental Metal Manufacturers, Ornamental Non-ferrous Metal Manufacturers and Ornamental Iron Manufacturers, S. J. Newman, president of Newman Brothers, Inc., Cincinnati, was for the fourth time elected president of the Metal Manufacturers' group; Henry J. Neils, of the Four City Ornamental Iron Co., Minneapolis, was re-elected president of the Non-ferrous Metal group; and B. W. Stonebraker of the Roanoke Iron Works, Roanoke, Va., was re-elected to head the National Association of Ornamental Iron Manufacturers.

Farrel-Birmingham Plants 98 Per Cent on War Work

• • • Ninety-eight per cent of the plant facilities of Farrel-Birmingham Co., Inc., Ansonia, Conn., and Buffalo, are engaged in war production, according to the company's annual report, which was this year illustrated with charts and pictographs and was sent to customers, as well as to stockholders and employees.



Front view of AMCO Rotary Hearth Furnace, including control panelboard, for heating all sizes of billets for shell forging.



*...are doing their part in America's
Victory Program*



AMCO Heavy Duty Furnace for large forgings; fired with Pulverized Coal; automatically controlled.

AMCO Continuous Charging-end-fired Slab-heating Furnace combined with AMCO Recuperator.



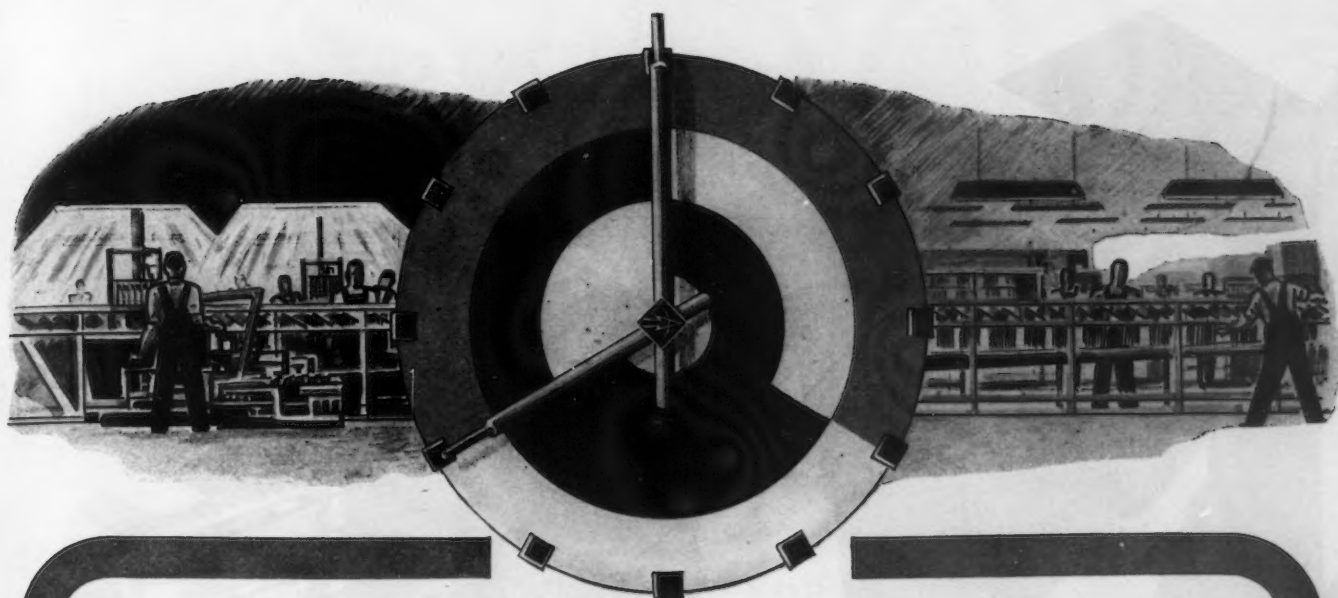
• The remarkable comparative production records being compiled by AMCO Ordnance Furnaces are truly significant. They mean that AMCO builds these furnaces up to the standard of its regular commercial equipment and not merely for a "quick turnover."

The new AMCO Principle and Method of "Artificial Loading" increases the efficiency, production and uniformity of all batch-type furnaces. Guns, tanks, armor-plate and other ordnance furnaces may be improved with this new AMCO principle.

If you are confronted with variables and losses due to non-uniform heating, put it up to AMCO!

The **AMSLER-MORTON** Company
FULTON BUILDING - PITTSBURGH, PA.





NIGHT AND DAY

Arcos Stainless Electrodes are being produced and are being used around the clock by the nation's welders. You can be sure, it's Arcos!

ARCOS CORPORATION
401 N. Broad St., Phila., Pa.



"QUALITY WELD METAL EASILY DEPOSITED"

Distributors Warehouse Stocks in the Following Cities:

ATLANTA, GA.	J. M. Tull Metal & Supply Co.	KINGSPORT, TENN.	Slip-Not Belting Corp.
BUFFALO, N. Y.	Root, Neal & Co.	LOS ANGELES, CALIF.	Ducommun Metals & Supply Co.
BORGER, TEXAS	Hart Industrial Supply Co.	MILWAUKEE, WIS.	Machinery & Welder Corp.
BOSTON, MASS. (Belmont)	H. Boker & Co., Inc.; W. E. Fluke	MOLINE, ILL.	Machinery & Welder Corp.
CHICAGO, ILL.	Machinery & Welder Corp.	NEW YORK, N. Y.	H. Boker & Co., Inc.
CINCINNATI, OHIO	Williams & Co., Inc.	OKLAHOMA CITY, OKLA.	Hart Industrial Supply Co.
CLEVELAND, OHIO	Williams & Co., Inc.	PAMPA, TEXAS	Hart Industrial Supply Co.
COLUMBUS, OHIO	Williams & Co., Inc.	PITTSBURGH, PA.	Williams & Co., Inc.
DETROIT, MICHIGAN	C. E. Phillips & Co., Inc.	PORTLAND, OREGON	Industrial Specialties Co.
ERIE, PENNA.	Boyd Welding Co.	ROCHESTER, N. Y.	Welding Supply Co.
FT. WAYNE, IND.	Wayne Welding Supply Co., Inc.	SAN FRANCISCO, CALIF.	Ducommun Metals & Supply Co.
HONOLULU, HAWAII	Hawaiian Gas Products, Ltd.	SEATTLE, WASH.	H. A. Cheever Co.
HOUSTON, TEXAS	Champion Rivet Co. of Texas	ST. LOUIS, MO.	Machinery & Welder Corp.
KANSAS CITY, MO.	Welders Supply & Repair Co.	SYRACUSE, N. Y.	Welding Supply Co.
		TOLEDO, OHIO	Williams & Co., Inc.



Rush it by

HAS a problem of internal grinding got you bottle-necked? Are there too many operations, too much lost time, too many spoiled pieces?

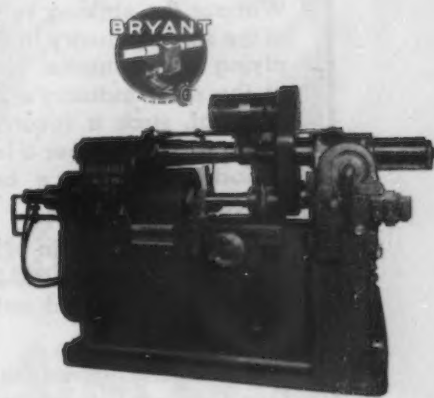
Then rush it by air mail to Bryant. In these hectic days your own engineers have problems enough without losing sleep over this.

Rush it by air mail to Bryant. Not only does Bryant specialize on internal grinding equipment. Not only has Bryant production already tripled, it is constantly increasing. Not only is Bryant all out for defense. There's another factor — Bryant's *specialized* experience in this highly specialized field is unmatched by any other organization devoted solely to internal grinding problems.

That's why it pays to air mail your problems to Bryant. Whether you're striving for defense today or studying how to cut costs and earn profits on new products for future markets, Bryant wants to help you. The thing to do with an internal grinding problem is rush it by air mail to Bryant.

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.



by **Air Mail to Bryant**

The Scrap Industry Has Done a Good Job

The facts and figures speak for themselves.

Steel ingot output in January, as reported by The American Iron and Steel Institute, was the largest for that month in the history of the industry.

The January total was 6,928,085 tons, closely approaching the all-time record of 7,242,683 tons in October, 1941.

For nearly a year and a half the steel industry has continuously operated at about 95% or better.

Without the striking record of the scrap industry in supplying a substantial share of the steel industry's raw material, such a record of steel production over a long period would have been impossible.

Purchased scrap in 1941 totaled nearly 25,000,000 gross tons, a record never before equalled.

The publicity given to a very few recalcitrants may have obscured the fact that the scrap industry as a whole is doing a monumental job in our war effort.

With steel capacity now at 88,570,000 tons annually and further additions under way, the scrap industry needs help from all sources to keep these enormous facilities in full operation.

The **CHARLES DREIFUS** Company

(Brokers in Iron and Steel Scrap for 40 years)

Philadelphia, Pa. Pittsburgh, Pa.
Widener Bldg. Oliver Bldg.
Rittenhouse 7750 Atlantic 1856

Worcester, Mass.
Park Bldg.
Worcester 6-2535

Canadians Aided by New, Simple Priority Methods

Ottawa

••• R. C. Berkinshaw, priorities officer in the department of munitions and supply, stated that the entry of the United States into the war enabled Washington to remove complications which slowed down the flow of vital war materials to Canada, and thus the war industries of this country will be able to speed their production.

He stated that on Feb. 28, the hitherto complicated procedure of obtaining United States priority assistance for Canadian war industries were abolished and new, simple methods will make it much easier to import essential machinery, steel, metals and other materials. "As far as war manufacture is concerned the situation is, in effect, as if the Canadian firms were operating without the existence of an international boundary," he said.

Recognizing the imperative need for a quick change-over to the new procedure, the Canadian Manufacturers' Association, Toronto, and the Canadian Chamber of Commerce, Montreal, have volunteered to assist the priorities officer in

making known the details. From these organizations manufacturers will be able to obtain full data.

Each month some 15,000 applications for United States preference ratings are being handled by the Canadian priorities branch.

Canada's January Steel Output at 257,069 Tons

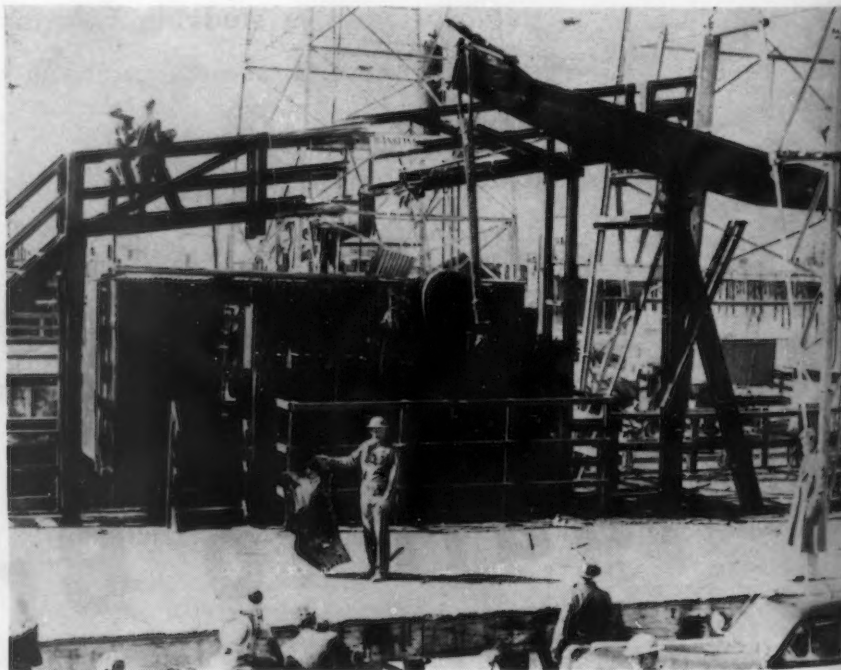
Toronto

••• Production of steel ingots and castings in Canada for the month of January rose to the all time high monthly record of 257,069 net tons, which compares with 244,846 net tons in December and 208,659 net tons in January, 1941, according to the Dominion Bureau of Statistics. (Previously the bureau quoted iron and steel production figures in gross tons, thus using net tons, figures show substantial gains over those previously quoted). Production totals for January this year include 243,693 tons of ingots and 13,376 net tons of castings, with ingot output about 97 per cent of capacity.

Canada's steel furnace capacity at the end of January last in net tons per annum was as follows:

WHERE JAP SHELL HIT: The only direct hit scored by the Jap submarine attack off Ellwood, Cal., was on the oil derrick in the Ellwood oil field. The 25 five-inch shells that were hurled at the field caused damage totaling only \$500, and no one was injured.

International News Photo



Canada Places Orders For 10,000 Planes

Toronto

• • • The Canadian government has placed orders with aircraft builders for upwards of 10,000 airplanes representing total value of more than \$500,000,000. Ralph P. Bell, director general of aircraft production, stated. The orders, which include several types of aircraft ranging from trainers to big bombers, are sufficient to keep every plant in Canada on capacity production to the end of 1943 and some contracts extend into 1944 and 1945. Canada's aircraft industry at the outbreak of war occupied 500,000 feet of floor space and employed 1000 workers. Today this industry occupies upwards of 5,000,000 sq. ft. and employs 40,000 men and women.

Ingots—basic open-hearth, 2,647,000; electric, 317,000. Steel castings, 200,000. Total ingot and castings capacity now totals 3,164,000 net tons yearly.

Pig iron produced in Canada during January totaled 163,156 net tons, a slight decline from the 166,182 tons reported for December and compares with 115,455 net tons in January a year ago. Output for the month included 134,495 net tons of basic iron, of which 5940 tons were for sale and the remainder for the further use of producing companies; 15,769 tons of foundry iron and 12,892 tons of malleable iron, all the two latter grades being for sale. In the making of the month's pig iron, 296,932 tons of iron ore were used. Ten out of the 11 blast furnaces in Canada were blowing throughout the month, with average production 94 per cent of capacity. The one idle stack now is undergoing repairs and will blow in later in the year at Algoma Steel Corp., Sault Ste. Marie, Ont.

Output of ferro-alloys during January amounted to 18,004 net tons compared with 19,986 net tons in December and 17,059 tons in January, 1941. January's output included the following in order of production: ferrosilicon, silicomanganese, ferromanganese, ferrochrome, ferrochrome silicon, spiegeleisen, calcium silicon and ferrophosphorus.



WYCKOFF

The Entire Facilities of
WYCKOFF DRAWN STEEL CO.

PRODUCTION, METALLURGICAL, SALES, MANAGEMENT

**ARE NOW BEING DEVOTED 100%
TO AMERICA'S VICTORY PROGRAM**



First National Bank Bldg., Pittsburgh, Pa. • 3200 So. Kedzie Ave., Chicago, Ill.
Mills at Ambridge, Pa. and Chicago, Ill.; Warehouse Stocks in Principal Cities
MANUFACTURERS OF CARBON AND ALLOY STEELS . . . TURNED AND POLISHED SHAFTING
. . . TURNED AND GROUND SHAFTING . . . WIDE FLATS UP TO 12" x 2"

G. A. WELDING Shop Notes

MEET THE "FAMILY"

The Plate & Welding Division, making steel plate equipment for Industry and Commerce, is but one activity of General American Transportation Corporation. You may have occasion to use other services of this organization; they are listed here for your information:

THE GATX FLEET -- world's largest privately owned fleet of special cars—tank, refrigerator, milk, stock, refrigerator express—available by trip, day or year.

GENERAL AMERICAN TERMINALS -- strategically located bulk liquid storage terminals at port of New Orleans, port of New York, Houston, Corpus Christi.

AEROCOACH -- pioneer low-weight, high economy, motor coach; built by G. A.

FREIGHT CAR MFG.—all types of freight cars; outstanding builder of specialized cars for unusual commodities.

PRECOOLING—For protection of perishables at point of shipment.

PLATE AND WELDING DIVISION
**GENERAL AMERICAN
TRANSPORTATION
CORPORATION**



98—THE IRON AGE, March 5, 1942

Swing Shift System Widely Used in Steel Industry

• • • To maintain maximum production of steel needed for the war, steel mills have generally adopted the four-crew or swing-shift system of scheduling work, according to the American Iron & Steel Institute.

Under this system, the industry has operated 24 hours each day, and has been able to avoid the weekend stoppage of work which would have reduced output of steel. Furthermore, it permits each worker to have 48 hours off at the end of approximately 40 hours of work, each week.

The four-crew system, adopted many months ago by most steel companies, necessitated the employment of thousands of additional workers when steel operations rose to capacity at the beginning of the defense emergency. Between August, 1939, and December, 1941, employment in the steel industry rose from 458,000 to 646,000 persons, a gain of 188,000.

Under the swing-shift system, each crew of workers takes turns on the three eight-hour periods into which each day's work is divided. Only three crews are needed on any one day. The fourth crew is needed to fill in during the days off periods of the various crews. There are 21 shifts or "turns" of 8 hours each in a seven-day week and if the four crews each worked five turns a week, they would account for a total of only 20 turns. Therefore, each week it is necessary for one of the four crews to work six turns. The crews are rotated so that once in every four weeks each crew is called upon to work the extra turn. Overtime pay at the rate of 1½ times usual hourly rates is paid for the sixth day's work.

Clark Controller Co. Output 98 Per Cent for War

Cleveland

• • • The Clark Controller Co. operated 98 per cent on war production in 1941, and at the year-end had the largest backlog of unfilled orders in the company's history. The company added 16,034 square feet of manufacturing space and office space to its facilities last year.

COMING EVENTS

- March 23 to 25—A.S.M.E. spring meetings, Houston, Texas.
- March 26 to 28—American Society of Tool Engineers, annual meeting, Hotel Jefferson, St. Louis.
- April 14 to 17—Packaging Exposition and Conference, Hotel Astor, New York.
- April 15 to 17—Open Hearth Conference, Cincinnati.
- April 15 to 18—The Electrochemical Society, spring convention, Nashville, Tenn.
- April 18 to 24—Foundry and Allied Industries Show, Cleveland.
- April 20 to 24—American Foundrymen's Association, Cleveland.
- April 27 to May 1—American Mining Congress, Coal Show, Cincinnati.
- May 11 to 13—American Gear Manufacturers Association, 26th annual convention, Hotel Hershey, Hershey, Pa.
- May 19 and 20—44th annual convention of National Metal Trades Association, Hotel Biltmore, New York.
- May 25 to 28—National Association of Purchasing Agents Convention, Waldorf-Astoria Hotel, New York.
- June 21 to 25—American Water Works Association, Chicago.
- Aug. 23 to 30—National Association of Power Engineers, New Orleans.
- Sept. 1 to 11—Building and Construction Trades Council, Atlantic City, N. J.
- Sept. 22 to 24—Association of Iron and Steel Engineers, Pittsburgh.
- Oct. 5 to 9—National Safety Congress Association, International convention, Baltimore.

Bureau of Standards Fixes Gas Floor Furnace Standards Washington

• • • A recommended commercial standard for gravity circulating type gas floor furnaces, known as CS99-42, effective May 25, has been accepted and approved by the National Bureau of Standards. The standard establishes minimum specifications for the guidance of manufacturers, distributors and users of gravity circulating type, natural draft gas floor furnaces for domestic use, and provides a uniform basis for guaranteeing compliance through the use of labels of certifications.

The standard covers the construction and installation requirements, including those furnaces having single or dual wall register outlets for use with natural, manufactured, mixed, and liquefied petroleum gases. It includes the sizing, placement, general installation requirements, venting, gas connections, and methods of certifying compliance with the code.

GIVE US CREDIT FOR THAT ONE



NO, we didn't shoot it down—but in the long chain of defense production McKee has been an important link in providing facilities for the production of America's two most vital wartime needs—steel and oil.

Since 1937 the McKee organization has undertaken iron and steel plant construction representing over 6 million net tons of *new capacity* and replacement of more than 2¼

million tons of existing capacity—a total of more than 8¼ million tons annually.

When the final score is added up you'll find no enemy planes brought down—no ships sunk by McKee. But to McKee's credit will stand the achievement of having in a large measure provided the means for the production of tanks and guns and ships and planes with which America is defending herself.




Arthur G. McKee & Company

★ *Engineers and Contractors* ★


2300 CHESTER AVENUE • CLEVELAND, OHIO

ROCKEFELLER PLAZA
NEW YORK, N. Y.

COMMERCE BUILDING
HOUSTON, TEXAS



Greater Tonnage
Per Edge of Blade



**AMERICAN
SHEAR KNIFE CO.**
HOMESTEAD · PENNSYLVANIA



WAR SHIFTS OLDS EXECUTIVES: A shifting of executives of Oldsmobile Division of General Motors has been made in connection with war production. Standing, left to right, are John Dykstra, named factory manager in charge of Olds gun plants; R. E. Griffin, production manager, with supervision over Olds contracts, sub-contracts, buying, expansion of ordnance production, schedules and methods. Seated, left to right, R. J. Wilkins, named Olds manufacturing manager; S. E. Skinner, general manager, and D. E. Ralston, new executive assistant to Skinner.

125-Mile "Production Line" Created by Subcontracting

Detroit

••• While subcontracting is not new to the automobile industry, the Automotive Council for War Production cites an instance of a "bits and pieces" program that is unusual. The firm involved is an automotive supply company which is manufacturing shell. One of the smallest pieces, the fuse hole plug is an iron casting which requires annealing, machining, cadmium plating and the addition of thread protectors before it is assembled in the shell. The prime contractor lacks foundry, annealing equipment, screw machines and cadmium plating facilities for this particular piece which was required in quantities of 20,000 per day.

This firm utilized the subcontracting procedure of the industry and found casting facilities nearby. Another firm in the city had annealing equipment. In a town 55 miles away a third firm had screw machine capacity available. Thirty miles northeast of that point in a third community a firm was found to do the cadmium plating.

A truck route was charted, beginning at the foundry each morn-

ing. Here the truck picks up 20,000 castings and delivers them to the annealing plant, where it takes on a similar number of annealed pieces, carries them 55 miles to the screw machine plant. Here a fresh load of machined parts is acquired and the truck goes on to the cadmium plating plant. Here, besides plating, the thread protectors are added (manufactured by another firm 70 miles away). Taking on the fourth load of the day the truck rolls 40 miles back to the home base to deliver the finished parts.

In effect, this war producer is operating a 125-mile motorized production line as an adjunct to its own plant operations.

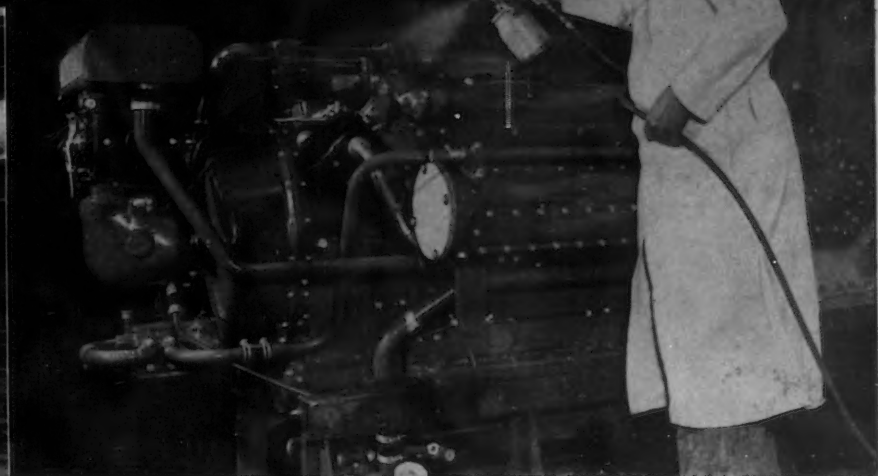
Packard Expects to be Employing 25,000 Workers

Detroit

••• On the basis of present assignments of war work, Packard Motor Car Co. will employ 100 per cent more workers by late 1942 than it normally has employed on automobile production. It was estimated by the company last week that total employment would be upwards of 25,000 workers compared with the 1941 auto employment peak of around 10,000.

MOSQUITOES

with a 4050 H.P. Sting!



Photographs by Packard Motor Car Company

Too small to hit—too tough to sink—too fast to stop—they're the sensational new PT Boats, the "Mosquito Fleet." They'll hurtle 70 miles an hour over any sea to sink a sub with depth-bombs, torpedo a raider, or blast a bomber from the sky. And they're going into active service in the Navies of the United States, Great Britain and Canada as fast as they can be built.

The power behind their deadly sting is Packard Motor Car Company's great 1350 horsepower marine motor, developed from aircraft engine experience of World War days! Each PT has *three* of these huge engines—4050 h.p.—to hurl it on at more than a mile a minute.

In two years Packard has built over \$17,000,000 worth

of these motors. A new order for \$19,000,000 is under way. Daily output has been multiplied many times.

Packard uses DeVilbiss Spray Equipment exclusively to paint these motors, as well as the thousands of Rolls-Royce engines it is building for American and British warplanes—just as it has used DeVilbiss Spray Systems for many years to paint Packard cars.

Other factories and arsenals all over this broad land are relying today on DeVilbiss Spray Systems to paint and coat many types of armament and munitions that are so urgently needed. If you have a defense contract *and a finishing problem*, here's the way to speed that last vital step between the assembly line and the line of duty.

THE DEVILBISS COMPANY • TOLEDO, OHIO

Canadian Plant: WINDSOR, ONTARIO

THE COMPLETE DEVILBISS LINE CONSISTS OF: Spray finishing equipment • Automatic coating machines • Tanks for spray materials • Spray booths and exhaust fans for vapor and dust elimination • Air regulators, cleaners and dusters • Air compressors • Respirators • Specialized hose for paint, air, water, gasoline, welding and pneumatic tools • Hose connections • Water and oil guns • Equipment to prevent offset in printing • Paint strippers • Medicinal atomizers • Perfume atomizers.



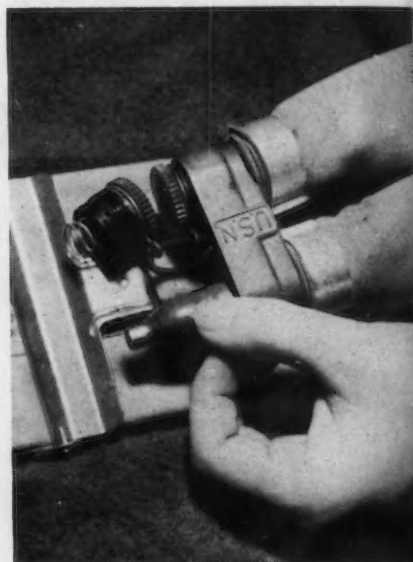
DEVILBISS SPRAY SYSTEMS

Oldsmobile Teaches Servicing of Cannon

Detroit

••• The first of a series of defense service schools organized by Oldsmobile Division of General Motors Corp. is in session now training enlisted men of the Army in the proper methods of servicing automatic cannon for fighting planes.

Technical men from Army air bases are delegated by the Ordnance Department to attend these classes. The trainees study complete gun assembly and inspection operations in the plant, are giving firing range courses which permit opportunities to check all functions of the gun and are then given courses in assembly and disassembly. The course covers three weeks.



Associated Press Photo

LIFEBELT WITH AIR CYLINDERS: This new type pneumatic lifebelt in an emergency can be inflated with air compressed in small cylinders of the type used to charge soda water for a highball. The cylinders are installed in containers at one end of the belt and the gas is released by squeezing designated place.



Garlock Packings permit you to avoid frequent shut-downs for re-packing . . . help you maintain your share of the all-out, full-capacity production needed for Victory. *Standardize on GARLOCK and be sure of long, dependable service.*

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

In Canada: The Garlock Packing Company
of Canada Limited, Montreal, Que.



GARLOCK 777

Spiral Packing for hot or cold water and low pressure steam.

Auto Industry Reports On Tooling Facilities

Detroit

••• The first report in the automotive industry specifying and listing available tooling facilities was forwarded Feb. 20 to all companies in the industry by the Automotive Council for War Production through its tooling information service.

The report lists, company by company, all those having facilities available in four major classes of work: gages, tools, jigs and fixtures, and dies. More than 80 manufacturing companies with surplus facilities available are included in the listing.

D. G. Clemmer has been named as a member of the ACWP staff to handle this work. Clemmer, associated with the automotive industry for 30 years, was employed by Cadillac Division of General Motors Corp. in production and manufacturing activities. Prior to 1915 he was connected with Stewart-Warner Corp., in Chicago and Detroit, in the engineering and sales departments. Clemmer will work under Chester A. Cahn, manager of the tooling information service of the ACWP.



"KEEP 'EM FLYING"



"KEEP 'EM BLASTING"



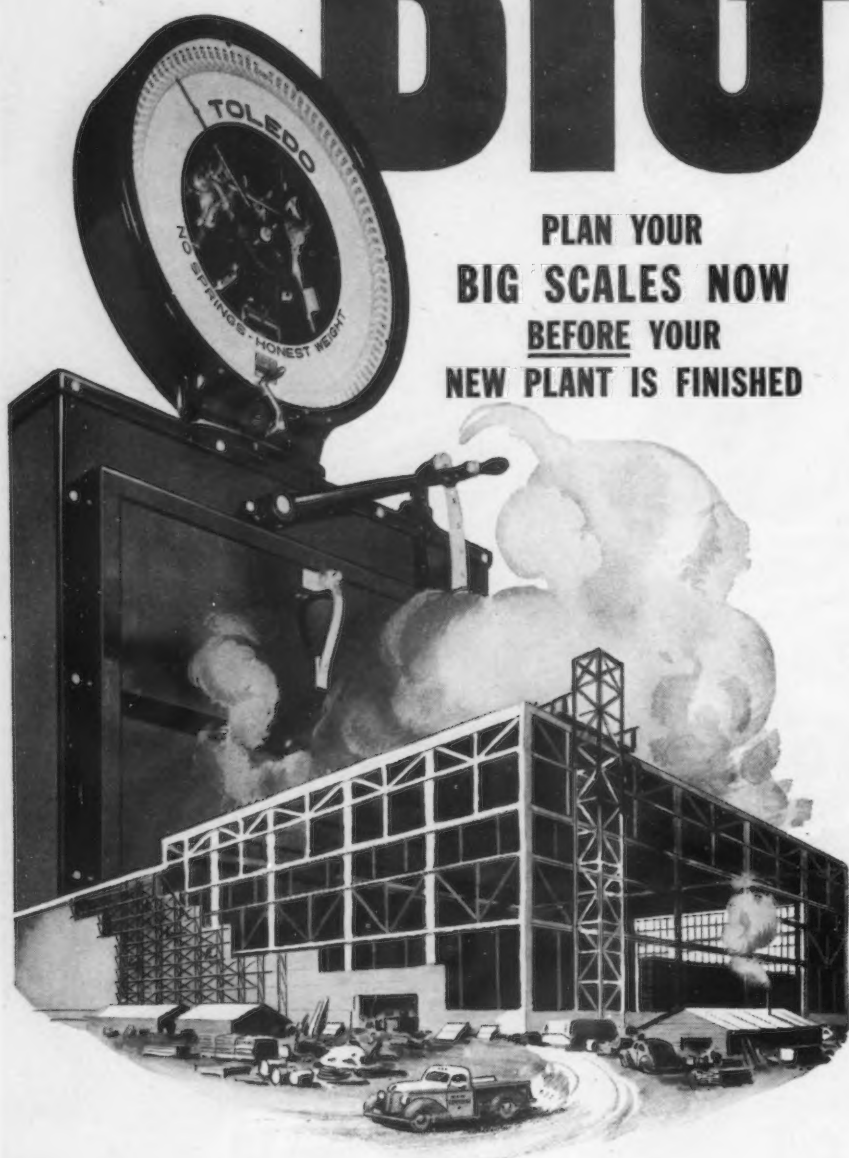
"KEEP 'EM SMASHING"

Ohio Ferro-Alloys Corporation
Canton, Ohio

TOLEDO BUILDS

BIG

PLAN YOUR
BIG SCALES NOW
BEFORE YOUR
NEW PLANT IS FINISHED



Wartime America has the greatest production control job ever attempted... a job for which Toledo Scales are vital! Whether it's a small scale for fractions of an ounce or the BIGGEST heavy-duty steel mill types or truck scales, built-in platform scales, hopper and tank scales... dial, beam or weight-printing scales... Look to Toledo for the answer!

Toledo has solved countless problems in weighing, balancing, force-measuring and counting... with the most accurate, rapid and reliable weighing machines obtainable. Write for information for your present scale needs... or for the requirements of your new plant while it is still in the "plan" stage. Service in 181 cities. Toledo Scale Company, Toledo, O.

IN WAR—AS IN PEACE

INDUSTRY LOOKS TO **TOLEDO**
FOR ALL TYPES OF **SCALES**

Electro Steel**Plant Refractories**

(CONTINUED FROM PAGE 43)

friends in the steel and refractories industries whose generous assistance will be acknowledged in more detail when the present series of articles has been completed.

Articles on Steel Plant Refractories, by J. H. Chesters, that have appeared in *THE IRON AGE* are:

"All Basic Open Hearth Furnaces," Aug. 15 and 22, 1940.

"Steel Plant Refractories," Feb. 6 and 13, 1941.

"Basic Open Hearth Above Sill Plate Level," May 22 and 29, 1941.

"Basic Open Hearth," Aug. 7, 14, and 21, 1941.

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30 R & M HOISTS

Speed this Firm's War Work!



◀ This view (with cover removed) shows the extreme simplicity of the R & M hoisting mechanism. Compact assembly reduces the amount of headroom and gives maximum strength. The entire mechanism can be removed after the cover is taken off.

There are no jams, no wasted time and effort in this war-gear plant! Material and finished products move like clockwork with the help of 30 R & M hoists.

You see three of the newest in action above. They're Cleveland Tramrail mounted 2-ton, all-steel super-production models with pendent, push-button control and a hoisting speed of 20 feet per minute. And spotted in other departments of the plant are 27 more R & M hoists, ranging from half-ton bantams to 5-ton huskies.

R & M hoists have provided the answer for faster material handling in all parts of the country. Their low headroom, ability to handle loads from any angle with perfect balance, and sturdy construction for trouble-free, year-around performance make them first choice for all types of industry.

Get in touch with nearest R & M sales and service office now. Or write the factory direct for complete details. It will pay you to "take it up" with R & M.

R & M SALES AND SERVICE OFFICES

Albany..... 364 Broadway	Cleveland... 352 Rockefeller Bldg.	New York..... 200 Varick St.
Atlanta..... 319 Walton Bldg.	Dallas..... 1100 Cadiz St.	Philadelphia... 401 N. Broad St.
Baltimore, Lombard & Concord St.	Denver..... 1420 16th St.	Pittsburgh.... H. W. Oliver Bldg.
Boston..... 55 Long Wharf	Detroit..... 2921 E. Grand Blvd.	San Francisco.. 237 Rialto Bldg.
Buffalo..... 2005 Delaware Ave.	Houston... 3715 Harrisburg Blvd.	Seattle..... 216-17 Walker Bldg.
Chicago..... 2400 W. Madison St.	Jacksonville... 305 Biabee Bldg.	Syracuse..... 204 State Tower Bldg.
Cincinnati..... 418 New St.	Newark..... 700 Bergen St.	
	Montreal... Lyman Tube & Supply Co., Ltd.	

ROBBINS & MYERS • Inc.

HOIST & CRANE DIVISION • SPRINGFIELD, OHIO

MOTORS • FANS • MOYNO PUMPS • FOUNDED 1878



World War II found **INGACLAD** Ready to Help Conserve Vital Alloys

Industries Served by IngAclad include:

Baking
Beverage
Canning
Chemical Processing
Chemical and Food Storage
Dairy
Dried Foods
Food Processing
Food Service
Meat Packing
Paint and Varnish
Pulp and Paper
Soap
Sugar Refining, and
Textile

In addition, IngAclad is widely used for Shipping Containers, Laboratory Table Tops and in a variety of Architectural Applications

● More than 10 years ago, a method of conserving vital alloys was developed by the Ingersoll Steel & Disc Division of Borg-Warner Corporation.

● This achievement in steel makes possible a saving of as much as 80% in the stainless steel required for many jobs.

● With a record of more than 10 years of continuous satisfactory service in the Process Industries, it is now performing a valuable service to the Allied cause.

● Not only does IngAclad conserve vital alloys, but also effects marked economies in material costs.

● Ease of fabrication and welds that are good for the life of the equipment are also characteristics of IngAclad.

● The reason IngAclad is so satisfactory in combating corrosion is that it is not a *substitute* for stainless, but actually is solid stainless steel applied uniformly and inseparably to mild steel.

We Produce Solid Stainless, Too!

As producers of both the solid stainless metal and Stainless-Clad Steel, we are able to advise you, without prejudice, as to which material is more practical for the particular service required.

If your stainless requirements are essential to the Nation's victory program and permit the necessary priority rating, we will do our very best to serve you. Inquiries are invited.

INGERSOLL STEEL & DISC DIVISION BORG-WARNER CORPORATION

310 South Michigan Avenue • Chicago, Illinois
Plants: Chicago, Ill.; New Castle, Ind.; Kalamazoo, Mich.

INGACLAD
STAINLESS-CLAD STEEL

*"A
Borg-Warner
Product"*

Automotive Branch of WPB Forms Labor Section

Detroit

••• A labor section attached to the Automotive Branch of the War Production Board at Detroit has been announced by Ernest Kanzler, chief. Frederick H. Harbison, assigned to Kanzler's staff from the Washington labor division of WPB, will have charge of labor relations, supply, training, housing, transportation and other matters pertaining to labor within the automotive industry. Harbison will have five assistants, George Seltzer, Chicago, specializing in employment; Allen Strachan, Detroit, labor relations; John Thurston, Detroit, of the Michigan Employment Service; and Theodore Veenstra of Washington, who will coordinate housing and transportation work.

Harbison is on leave from the University of Chicago where he is assistant professor of economics.

Harbison has named William Conover, who comes from the Washington labor division, in charge of the Detroit training program.

Other recent additions to Kanzler's staff includes Hugo Weissbrodt, superintendent of the International Harvester Co. plant at Springfield, Ohio. He joined Kanzler as a technical consultant.

Ernest Remenschneider of Grass Lake, Mich., former superintendent of Midland Steel Co., Cleveland; D. J. Hutchins, Detroit, district sales representative of the Firestone Tire and Rubber Co.; Marx Leva of Selma, Ala., senior attorney of the WPB, Washington; Joseph E. Gilbert of Chicago, former western manager of "Automotive Merchandising"; S. H. Worrell, Detroit, formerly of the Priorities Division; and M. J. Fox, Jr., of the statistics division, WPB, are also on the staff.

January Tool Shipments Increase to \$85,200,000

••• Machine tool shipments in January moved forward to \$85,200,000, according to an estimate by the National Machine Tool Builders' Association. December shipments, always seasonally high, were slightly less at \$85,100,000. Production in January of last year was estimated at \$50,700,000.

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AIR RAID SIRENS: The Sparton siren model 100, shown above, can be used where electric power is not available. Its specifications: overall height, 9 in.; housing dia., 7½ in.; rotor dia., 5½ in.; depth, 6¾ in.; wt., 5½ lb.; sound volume, 107 decibels at 25 ft., 96 decibels at 100 ft. Manufacturer is Sparks-Withington Co., Jackson, Mich.

Auto Makers Asked to List Sources of Information

Detroit

••• To open up necessary vital channels of information about machine tools and equipment in the plants of automobile manufacturers and automotive suppliers, E. C. Brandt, chief of the machine tools and equipment section of the Automotive Branch, WPB, in Detroit, has asked each automotive manufacturer to fill out a blank giving the names, positions, telephone numbers and extension lines of individuals who can supply information or assistance on the following specific subjects: Availability of used machine tools; cutting tool problems; new machinery problems; jigs, fixtures and gages and electrical equipment. The information and names thus gathered will be used by the WPB to facilitate telephone calls and other communications with manufacturers.



Just one purpose . . . good threads . . . but many Murchey Threading Tools are available to help you achieve that purpose in the best way. Write Murchey about your threading problem.



MURCHEY TYPE "G" (NON-ROTATING) SELF-OPENING DIE HEAD



Keep YOUR PLANT OPERATING while laying *Carey Elastite* INDUSTRIAL ★ FLOORING

This Modern, HEAVY-DUTY Flooring meets Demand for ALL-OUT Economical Production

To speed production—get rid of rough, dangerous, energy-wasting floors—surface them with CAREY ELASTITE Industrial Flooring. Lay it during week-ends; use it immediately. Prevent shutdowns; save time.

Smooth and resilient under foot, CAREY ELASTITE increases workers' efficiency. A printing concern found, that since application of this flooring, two men easily move a 4,000 lb. skid of paper which previously required four to five men for the job.

CAREY ELASTITE Industrial Flooring is TOUGH, long-wearing, non-skid, dustless; lessens accidents and breakage of trucks and tools. It is fire-resistant; practically noiseless under steel-wheel traffic. Its favorable first cost, long service and low maintenance, reduce floor overhead.

THE PHILIP CAREY MANUFACTURING CO.

Lockland, Cincinnati, Ohio

Dependable Products Since 1873

IN CANADA: THE PHILIP CAREY COMPANY, LTD.

Office and Factory: LENOXVILLE, P. Q.

If you have a floor problem, don't experiment. Solve it with CAREY ELASTITE Industrial Flooring. Write today for folder giving full details. Address Dept. 26.

Great Lakes Steel Corp. Making Armor Plate

Detroit

• • • Great Lakes Steel Corp., Ecorse, Mich., having converted its 96 in. continuous hot mill for the manufacture of steel plate, is into production of armor plate, it was announced here last week by George R. Fink, president.

As a result of the conversion, Great Lakes' plate making capacity is increased more than 15 times, to 350,000 tons a year.

Adapting the 96 in. mill for plate, required the installation of special shearing, finishing and handling equipment. The job was accomplished in six months, contrasted with a requirement of 18 months for construction of entirely new facilities, Fink pointed out.

The start of plate making is the second phase of Great Lakes' expansion program for war production. Recently the firm blew in its new blast furnace, claimed to be the largest in the world.

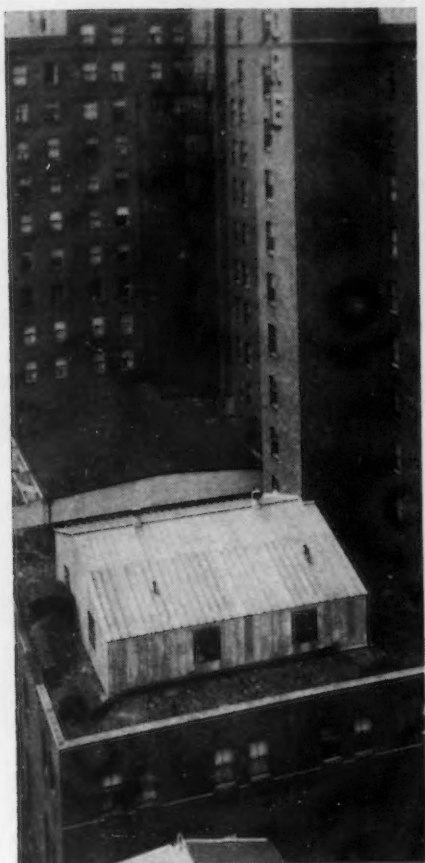
Dues Drive at Gary Proves to Be Quiet Affair

Gary, Ind.

• • • Dues picketing at the Gary sheet and tin mill of Carnegie-Illinois Steel Corp. by the SWOC last week turned out to be merely a perfunctory performance. Actually no one was refused admittance to the plant despite union's announced determination to keep out all non-members. Because of the "build-up," the steel producer asked the city to promise police protection, and its own armed guards, who have full police functions since Dec. 7, were on hand to insure quiet picketing.

Lyon, Conklin Elects Officers

• • • Lyon, Conklin & Co., Inc., Baltimore, makers of alloy metal products have elected as officers for 1942 the following: Edgar Lyon, president; Osborne F. Murphy, vice-president and general manager; Irwin J. Wilcoxon, vice-president and secretary; Ryland G. Bristow, treasurer; Charles S. DeMuth, assistant treasurer and J. Laroy Perkins, assistant secretary. Elected to the board of directors were the officers and Charles A. Fink.

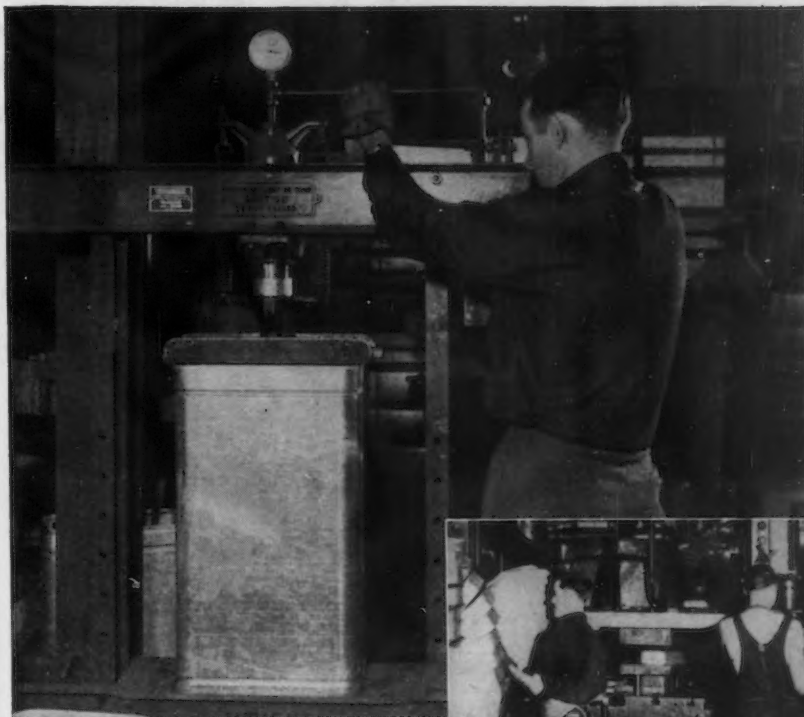


NEW USE FOR A PENTHOUSE:

To store supplies which were filling rooms needed for business men visiting Dayton, Ohio, a war boom town, this 500-room Dayton hotel ordered the steel penthouse shown above. The structure was made of Steelox panels after plans for a masonry addition were rejected by the Dayton city engineering department because of its weight.

Open Hearth Meeting Begins in Cincinnati April 16

••• Steel executives, blast furnace operators, open hearth and Bessemer steel men will meet at the Netherland Plaza Hotel, Cincinnati, April 16 and 17, at the 25th national open-hearth and blast-furnace conference of the iron and steel division, American Institute of Mining and Metallurgical Engineers. More than 800 are expected to attend this conference whose theme is "More Production in the Blast Furnace and the Open Hearth for National Defense." At the annual fellowship dinner, April 16, Bennett Chapple, assistant to the president, American Rolling Mill Co., will be toastmaster, and C. R. Hook, president of the same company, will be the speaker.



Courtesy Porcelain Metals Corporation of Louisville.

In war as in peace ARMCO Galvanized ZINCGRIP is ready to do its bit. At top, powder cans for the Army drawn from this special zinc-coated metal; at bottom, fuel reservoirs for peace-time use.



SAVED: 50% ZINC

When a manufacturer used ARMCO Steel ZINCGRIP in redesigning a powder box for the Army, this is the way he said "thumbs up!" . . .

- Saved at least 50 per cent of the zinc consumed by the old method.
- Reduced the weight of each box 10 per cent (four pounds).
- Stepped up production. • Guarded against powder contamination.
- Assured corrosion resistance and long service life for these boxes.

The reasons? ARMCO ZINCGRIP is a mill-coated, galvanized metal—ready for drawing and forming operations. The tightly adherent ZINCGRIP coating won't flake or peel in a press. This means unbroken zinc protection along the edges.

Are you making war equipment that might cost less and work better if you used ARMCO Galvanized ZINCGRIP sheets or coils? Let's talk it over. Just address your letter to The American Rolling Mill Company, 991 Curtis Street, Middletown, Ohio.

A LABEL KNOWN TO MILLIONS



Train Labor for Combat Duty, Urges Reuther of UAW-CIO

Flint, Mich.

• • • Members of labor unions and other civilian organizations should be organized and trained as auxiliary fighting units to be called into action in the event of enemy attack on coastal cities and de-

fense production areas, Walter P. Reuther, director of the General Motors department of the UAW-CIO, urged Feb. 22 in an address before a meeting of tool and die makers employed in Flint GM plants.

"President Roosevelt has told us bluntly that under certain conditions Detroit and New York could be bombed from the air. I know that aerial attacks are not inva-

sions, yet we must by now realize that the ruthlessness and strength of the enemy may mean attempted invasions of our cities—if not tomorrow, then perhaps in months," he said.

"Even if actual invasion never takes place, we dare not discount the possibility. There has been entirely too much hindsight; let us plan for any emergency. This is all the more important when we realize how badly equipped for self-defense are some of our coastal cities and our defense areas, like Detroit and Flint.

"The armed forces are our strongest protection. They must have direction of whatever combat may be necessary. Yet there is a great reservoir of millions of Americans, workingmen and women among them, who could be of vital service in the event of an attempted invasion. American workingmen, maintenance men and construction workers, at Guam dropped their tools and seized guns to fight by the side of the Marines.

"The workers of our cities, and the women, if necessary, would be ready to do the same. The people of Madrid, of Leningrad, the spirit of the London populace, have turned the tides against invaders. American workers will do no less. They hate the Axis, they will do whatever they are called on to do to defend America. I know that in the event of an invasion in Detroit—a city more vulnerable from the air than New York—the hundreds of thousands of auto workers would get out their deer rifles and take their places beside the military.

"We have this potential fighting force. Steps should be taken now to give it the rudiments of discipline, of military organization. I believe the labor unions and the members of other civilian organizations would respond to such service. It is the most vital civilian defense step we can take.

"A year ago we urged conversion of the auto industry for war production—now we must urge a greater conversion program. We must convert the entire nation into a fighting organization to support our regular armed forces. We must build civilian fighting units to defend our plants, cities and homes—fire fighters and first aid are important, but not enough!"



NOTED FOR SMOOTHNESS

ONE of the benefits of Hele-Shaw Fluid Power (oil under pressure) that you are going to like is its smoothness. The oil under pressure from a Hele-Shaw pump is transmitted to the press, ram, or driven machine in a smooth, even flow. There's no vibration or thumping or jerking in the driven machine. The ram speeds up or slows down quickly. Even flow is responsible for greater accuracy in operation, longer life of the machine. Smoothness of Fluid Power is produced by a multiplicity of plungers in the pump itself. Investigate the smooth operation of Hele-Shaw Fluid Power and the many other advantages of Fluid Power by sending for our catalog.

NOTE IT FOR SMOOTHNESS




THE
Hele-Shaw
Fluid Power Pump

Cross sectional view of the Hele-Shaw Pump showing the multiplicity of plungers which are responsible for the smooth, even flow of Hele-Shaw Fluid Power.

Southwark - Tate - Emery Universal Testing Machine, smoothly powered by a Hele-Shaw Pump.

OTHER A-E-CO PRODUCTS: LO-HED HOISTS, TAYLOR STOKERS, MARINE DECK AUXILIARIES

AMERICAN ENGINEERING COMPANY
2410 ARAMINGO AVENUE, PHILADELPHIA, PA.



PAINTING WITH GOLD: A workman at the Westinghouse porcelain plant at Derry, Pa., is pictured applying a gold-platinum paint to a porcelain insulator. Solder readily adheres to this metal wrapping, forming the required air-tight connection to keep out moisture and dirt when the insulators are attached to such electrical apparatus as transformers, capacitors and circuit breakers.

Yuill Made Director of Shipbuilding Branch, Canada

Ottawa

• • • C. D. Howe, minister of munitions and supply, has announced the appointment of Russell Yuill as director of the shipbuilding branch. He joined the shipbuilding branch in May, 1940, and is on leave from the national harbors board. Mr. Howe also announced the appointment of H. J. Leitch as assistant to the director general of the shipbuilding branch. Mr. Leitch is on loan from Algoma Steel Corp., Ltd., where, at the time of his appointment, he was general sales manager. Previously he was manager of the Sault Structural Steel Co.

Training Within Industry Program Expands in Pa.

Philadelphia

• • • H. W. Jones, district representative of the Training Within Industry branch of WPB for Eastern Pennsylvania, announced that 200 trained job instructors per week are now being turned out within war industries in the area, and that training conferences are

in operation or scheduled in 70 plants in the district.

Some of the companies in which the program is now being used are Standard Pressed Steel Co., Philco, Electric Storage Battery Co., Baldwin Locomotive Co., Hamilton Watch Co., Summerill Tubing Co., Westinghouse Electric & Mfg. Co., Armstrong Cork Co., Sun Shipbuilding Co. and York Ice Machinery Co.

Today . . . It's "Follow-Through" That Counts



There is a "follow-through" responsibility resting on the shoulders of everyone in industry today. It demands an attitude of greater care and interest-beyond-your-own-job. It's insurance against waste of precious time and materials.

Here at Accurate we are all conscious of it — from the switchboard through the shipping room—efficiency is the watchword. With this coordination of man and woman power we are producing more and faster and better products — most of them for munitions and vital equipment.

We have accumulated experience in our job, and in the spirit of "follow-through" we offer it to those who have problems in which springs, wireforms, or stampings are important. If you have such problems bring them to us. You'll like the cooperation and service at Accurate.



*Accurate
Springs*

ACCURATE SPRING MFG. CO.
3819 W. Lake St. Chicago, Ill.
SPRINGS • WIREFORMS • STAMPINGS

Bookings Increased for Baldwin and Subsidiaries

Philadelphia

• • • Charles E. Brinley, president of Baldwin Locomotive Works, announced, Feb. 25, that orders taken in January by the company and subsidiaries, including Midvale Co., totaled \$32,784,835, compared with \$12,721,046 for January, 1941. Con-

solidated sales billed, including Midvale, in January aggregated \$13,830,021 (including billings of cost under cost-plus-a-fixed-fee contracts) as compared with \$5,487,974 in January, 1941. On Jan. 31, 1942, consolidated unfilled orders, including Midvale, amounted to \$270,616,499, compared with \$251,978,723 on Jan. 1, 1942.

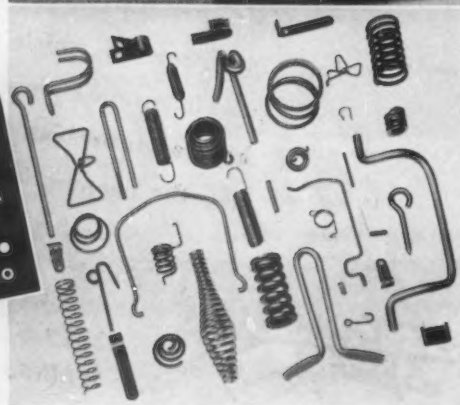
**a 24 hour
REVEILLE!**

**on
SPRINGS
WIRE SHAPES
SNAP-CLIPS, etc.
FOR U. S. DEFENSE**

KEEP SPRINGS FLOWING to industry... keep production on a continuous, unbroken schedule, 24 hours a day where necessary... that's Cuyahoga's contribution to Uncle Sam's defense program and industry's production needs!

If you need springs, wire shapes, or Snap-Clips as a vital part of your supply line, Cuyahoga has the production facilities, the precision and the craftsmen to serve you dependably.

**THE
CUYAHOGA
SPRING CO.**
10280, BEREA RD. - CLEVELAND, OHIO



TIP FROM TOKIO: Employees of a Douglas Aircraft Co. plant study a poster explaining the need for material conservation. The plant now salvages large quantities of items such as rivets and screws, machine tailings, dural odds, and ends, foundry dross, fittings, and imperfect parts and accessories.

Structural Steel Bookings Exceed Deliveries in Jan.

• • • New business booked by the fabricated structural steel industry during January was about 12 per cent more than deliveries of completed work that month. The new business booked in January of this year was 37 per cent less than the new business booked in January, 1941. Shipments of finished work during this January were 4 per cent less than for the same month last year.

During the last five months of 1941 the industry shipped each month more tonnage than was currently booked in new business. The change in the trend during January was probably due to the interim between the completion of the defense program and the starting of the war program.

Following is the complete tabulation of bookings and shipments:

	Est. Total Tonnage for Entire Industry 1942	Est. Total Tonnage for Entire Industry 1941
Contracts closed, January	176,625	281,235
Shipments, Janu- ary	157,986	164,590
Tonnage available for fabrication Within the next four months ..	704,452	1,210,000

Standard Steels Gain In Use; Mills Aided

••• Production of steel for war equipment is being facilitated as steel producers and consumers concentrate more and more on making and using a relatively small group of standard steels rather than literally thousands of special-order steels, according to the American Iron & Steel Institute.

The standard steels on which emphasis is being laid consist of a group of 87 alloy steels and 77 carbon steels selected after a two-year period of study and research by steel operating executives and metallurgists working through the Institute. Hitherto, carbon and alloy steels had been made in more than 4000 different combinations of chemical elements.

Last year the groups of standard steels represented approximately 90 per cent of the total output of carbon steel, 70 per cent of the alloy steels made in open hearth furnaces, 85 per cent of the electric furnace alloy steels and 100 per cent of the stainless steels. In 1942, it is expected standard steels will constitute an even greater proportion of the total steel output.

S.A.E. Meeting Will Hear Symposium on Engine Tests

••• Nine technical papers, including a symposium on production testing of engines, will be presented March 12 and 13 at the Society of Automotive Engineers national aeronautic meeting, Hotel New Yorker, New York, John A. C. Warner, secretary and general manager has announced. Engine testing techniques used by the aircraft engine departments of Ford Motor Co., Packard Motor Co., and Allison and Buick Motor Car divisions of General Motors Corp. will open the meeting Thursday morning. Rudolph F. Gagg, Wright Aeronautical Corp., will be chairman of the session.

A detailed study of the Junkers 211-B, a 1000-hp. 12-cyl. liquid-cooled aero engine, shot down in action and shipped to this country by the Army Air Corps, will be reported upon by Sidney Oldberg

and T. M. Ball, Chrysler Corp., Thursday afternoon, C. F. Bachle, announced. He will be chairman. J. T. Burwell, Massachusetts Institute of Technology, will report on "The Role of Surface Chemistry and Profile in Boundary Line Lubrication" at this session.

The annual banquet of the National Aeronautics meeting will be held in the New Yorker ballroom Friday evening.

National Acme Earnings At All-Time Peak

Cleveland

••• National Acme Co. made an all-time record profit of \$3,145,104 in 1941, after deducting \$6,625,000 in excess profits and normal income taxes. Per share earnings were equivalent to \$6.29, as compared with \$4.39 a share in 1940, when \$2,199,147 was earned.

A VETERAN OF 2 WARS !

1917 1942

★ Twenty-five years ago a spring manufacturer filled his quenching tank with 40,000 gallons of Houghton's Quenching Oil. ★ Today, amid the many improvements made in the heat treat, that tank still stands, filled with the same oil poured in it originally. Only slight replenishments have been necessary to make up the carry-away loss. ★ Literally millions of springs have been hardened in that tank during the past generation . . . hardened uniformly without sludging, fractional distillation or

chemical change in the oil. Only Houghton Quenching Oils can show such a record. How about your quench tanks?



E. F. HOUGHTON & CO.
PHILADELPHIA

Chicago

Detroit

If you're quenching shells, you'll want Houghto-Quench "G" for rapid quenching speed.

For every kind of oil-quenched work, there's a Houghton oil . . . made solely for quenching.

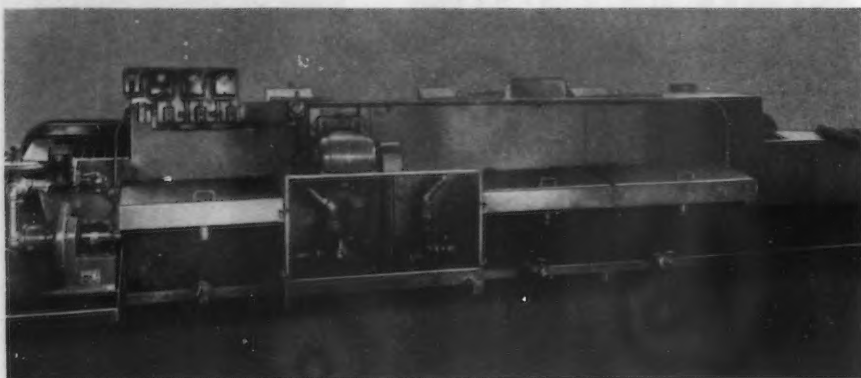
HOUGHTON'S QUENCHING OILS

Canada Permits Steel Price Rise; Empire Sheet Gets Relief

Toronto

• • • Authorization has been granted by the Wartime Prices and Trades Board to increase Canadian prices on a number of steel products \$5 per ton. The higher prices are retroactive to Feb. 16, according to announcement by Algoma Steel Corp., Ltd. While

Algoma Steel has circularized customers regarding the price advances, representatives of other Canadian steel mills stated late last week they have not been informed of any price changes from their head offices. However, it should be pointed out that for the past two years, on all steel orders



Another **RANSOHOFF** Development

**ESPECIALLY ADAPTED for the EFFICIENT
CLEANING of 75, 90, 105 and 155 MM PROJECTILES**

This new Ransohoff machine washes, rinses and rust proofs.

It saves valuable man hours, increases production and produces a better final finish.

Don't let old fashioned hand methods handicap your operations. Use Ransohoff Equipment and get better results.



WRITE OR WIRE DEPT. 1A for
CATALOG or FURTHER INFORMATION

N. RANSOHOFF, Inc.

TOWNSHIP and BIG FOUR R.R.

CINCINNATI, OHIO

closed, it was stipulated that the price would be made known at time of delivery.

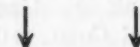
Under the new price revision carbon and alloy bars, structural shapes, sheet piling, black sheets, grinding balls and track fastenings are advanced 25c. per 100 pounds. The price of forgings and light rails is increased \$5 per ton, and heavy rails, \$3 per ton.

Canadian mills are maintaining capacity production. Practically all orders now being closed are on war account. Although mills are accepting new business, delivery dates are decidedly uncertain. Promises on new bar orders are at best five months into the future, although this may be pared considerably on special request of the steel controller, and where it affects some vital war industry. On carbon and alloy bars orders are being taken for delivery eight months to a year ahead. No orders are being accepted for sheets, other than those coming through government sources. Demand for plate is absorbing all Canadian production and also is responsible for a substantial increase in imports from the United States. It is reported Dominion Foundries & Steel, Ltd., Hamilton, Ont., will start work soon on a further extension to its plate mill. Dominion Steel & Coal Co., Ltd., Sydney, N. S., is completing work on its plate mill and is scheduled to go into production about April 1.



Empire Sheet & Tin Plate Gets \$5 Per Ton Exemption

• • • The Empire Sheet & Tin Plate Co., Mansfield, Ohio, has been granted an exemption of \$5 a ton on sheet bars and \$2 a ton on ingots by OPA. This exemption permits the company to sell sheet bars at \$39 and ingots at \$33. The Price Control Act permits sales above the ceiling prices when an OPA examination of books respecting earnings and other data justifies such action.



Fabricated Bar Ceiling Soon Pittsburgh

• • • Work is progressing at OPA, it is understood, on the drawing up of a price ceiling for the fabri-

cated concrete bar industry. It is believed the ceiling will be set within a month or two, indicating base prices at established basing points for fabricated concrete bars—cut and bent—involving both bar mills and fabricators.

Freight Rate Increase Granted; Iron Ore Exempt

••• The advance in railroad freight rates authorized this week by the I.C.C. will add to the assembly costs of steel makers bringing their coal from a distance. No increase was approved for underground or hydrated iron ore and iron sinter, for which the carriers had asked advances of 4 to 7c. per gross ton. Scrap, pig iron, steel products and machinery are included.

The increases probably will go into effect later this month.

The higher rates, approved for the "duration" and for six months after the end of the war, include:

An increase of 3c. per net ton on anthracite, bituminous coal, coke and lignite when present rate is \$1 or less and of 5c. when it exceeds \$1. The rates a gross ton are a cent more in each case.

A 3 per cent advance on gravel and sand; phosphate rock; bentonite; dolomite; feldspar; fire clay; fluxing stone; iron pyrites; furnace slag; crushed stone; crushed and pulverized limestone, and other mine products, as well as basic or raw products of agriculture.

A 6 per cent increase in accessorial charges including c.o.d. service, diversion, dumping, floatage, handling, holding cars, inspection, lighterage, loading and unloading, reconsignment, spotting, storage, switching, trimming, etc., but not including protection against heat or cold, demurrage, dockage, tipping or tollage.

Fractions—In connection with rates or charges of 5c. or lower, fractions are to be resolved to the nearest quarter cent; between 5 and 10c. to the nearest half cent; over 10c. to the nearest cent except on grain and grain products where it will be to the nearest half-cent.

Warehouse Changes Studied

••• Several problems are understood to be under consideration currently in connection with Price Schedule No. 49, covering iron and steel warehouse sales, and may result in amendments by OPA.

Ceiling on Bolts Nears

••• The new maximum price schedule covering bolts, nuts and rivets is expected to be issued by OPA late this month. The industry is now supplying facts concerning a simplified stock list which is to be issued in cooperation with WPB, the Army, Navy

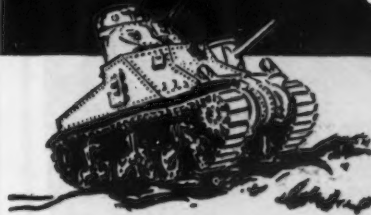
and Maritime Commission, and which will have bearing on the price structure.

Rescinds Brake Shoe Boost

••• Complying with a request of OPA, American Brake Shoe & Foundry Co. has rescinded a recent increase in its price of brake shoes,

Leon Henderson, OPA Administrator, announced Feb. 26. With the withdrawal of the \$2 per net ton price advance made on Jan. 1, 1942, the company's brake shoe prices are again at Oct. 1, 1941, levels.

Soon after the effective date of the \$2 advance, OPA initiated an investigation which, after careful study and conference with representatives and officials of American



JOHNSON BRONZE
Sleeve Type Bearings...

In Action on all Fronts

Out where they are shooting . . . or back home where they are producing . . . you will find JOHNSON *sleeve type* BEARINGS in action! It makes little difference whether the application is in a tank or a machine tool . . . a plane or a punch press, the same high standard of quality . . . the same careful attention to detail governed the production of the bearings.

Few parts of a motive unit carry the same degree of responsibility as the bearings. One faulty bearing can hold up an entire line of production or hamper the action of our armed forces. That is why it is so important to insist on quality.

One way to be sure of quality is to specify JOHNSON BRONZE for all your *sleeve type* bearings.



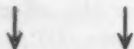
JOHNSON BRONZE

Sleeve BEARING HEADQUARTERS

505 S. MILL STREET • NEW CASTLE, PA.

Brake Shoe, culminated in the issuance of a request that the increase be rescinded.

Sales made at the higher prices will be adjusted to Oct. 1 levels by refunds.



MRC Excepted from Schedule

• • • Purchases by Metals Reserve Co. of idle or excessive inventories

of aluminum materials, in accordance with the program announced by WPB on Feb. 24, will be excepted from provisions of the aluminum scrap price schedule, OPA announced Feb. 28. This ruling was made in Amendment No. 1 to Revised Price Schedule No. 2. The purpose of WPB's program is to acquire aluminum materials comprising idle or excessive inventories held by manufacturing

users of aluminum. Regardless of prices at which these purchases are made, the MRC will sell aluminum materials which are to be remelted at no more than the maximum prices established by the price schedule for aluminum scrap.



Bicycle Price Stability Asked

• • • An OPA request to the bicycle industry, Feb. 21, asked that prices for new machines and parts be held at Jan. 15 levels. This request applies to suggested retail as well as wholesale prices.

While not mentioning the "Victory" bicycle by name, the letter asks that proposed price lists with respect to all new models added after Jan. 15 be submitted to OPA for approval "well in advance of the planned introduction to the trade."



Non-Ferrous Foundry Sessions

• • • Southern and Western non-ferrous foundry operators are conferring with executives of OPA in a series of regional meetings to discuss the industry's price problems. A meeting was held Feb. 27 at Denver; March 2 at Seattle, March 3 at San Francisco. Other sessions on the schedule include:

March 4, Cincinnati, Netherlands Plaza Hotel; March 5, Los Angeles, Biltmore Hotel; March 11, Atlanta, Ansley Hotel; March 12, Kansas City, Continental Hotel; March 13, Dallas, Baker Hotel.



Sporting Firearms Price Action

• • • Makers of sporting firearms have been asked by OPA to prevent advances in prices of rifles and shotguns to levels above those in effect Jan. 10. While the letter was directed only to manufacturers, OPA pointed out, retail levels would be watched closely for unjustified price increases.



Chemical Firm Aided

• • • Harshaw Chemical Co. has been authorized by OPA to pay 11¼c. per lb., f.o.b. shipping



B-O-O-O-M-M!

THIS field mine means business—and sudden destruction to any heavy equipment passing over it. It is one of the many small but effective instruments of war now being mass produced for our armed forces.

It is hard to believe that an instrument which can cause such havoc and debris and dirt must actually be cleaned before it is finished. But that is the case.

Cleaning field mines is just one of the many metal cleaning jobs done by Wyandotte for the Army these days.

Wyandotte men and materials are busy helping arsenals and metal industries to produce the materials of war swiftly and surely. If you have a problem in metal cleaning, there's a Wyandotte man waiting to help you.



THE J. B. FORD SALES COMPANY

WYANDOTTE, MICHIGAN

points, for such special purpose scrap as it requires. This is the fourth permission granted to purchasers of special purpose copper scrap. The other three are Metals Refining Co., Sherwin-Williams Co., and Superior Copper Products Co.

person said, would permit OPA to prepare interpretations in conformity with Procedural Regulation No. 1, requiring that all interpretations be in writing.

scrap) were announced Feb. 27 as the revised schedule became effective. The points, in question and answer form, follow:

Q—May a dealer, who is also a consumer, buy copper scrap or copper alloy scrap, which he plans to resell as scrap, at prices in excess of the maximums established by Price Schedule No. 20?

A—No. Section 1309.67 defines as a consumer any person whose business in whole or in part, whether in his own plant or on toll, consists of smelting, refining, melting, or otherwise processing copper or copper alloy scrap into a form other than scrap. Any person who uses any copper scrap or copper alloy

(CONCLUDED ON PAGE 120)

Schedule No. 20 Clarified

• • • Clarification of certain provisions of revised Price Schedule No. 20 (copper and copper alloy

Kennedy Heads Castings Unit

• • • Donald D. Kennedy has been appointed chief of the castings unit of the Iron and Steel Section of OPA, replacing J. E. McDonough, who has been called into military service. Mr. Kennedy, whose unit includes supervision of grey iron, malleable iron, steel, manganese and high alloy castings, comes to OPA from the University of Newark, Newark, N. J.

Ceiling on Springs, Beds

• • • A 60-day temporary maximum price regulation has been set by OPA upon manufacturers' prices for springs, mattresses, metal beds and cots, and studio couches. Maximums are set at the levels as of Feb. 23.

Price Clinic in Los Angeles

Washington

• • • Price Administrator Leon Henderson has announced that Los Angeles has been selected as the site for the third of a series of non-ferrous scrap metal price clinics. This clinic will be March 6, in the Assembly Hall of the Embassy Auditorium, 847 South Grand Avenue.

Purpose of the meeting is to explain the price schedules covering non-ferrous scrap metals.

Asks Questions be Written

Washington

• • • Price Administrator Henderson has suggested that persons seeking interpretations of Price Schedule No. 88 (petroleum and petroleum products) should submit requests for such interpretations in writing at least a week before any contemplated personnel consultation with OPA's fuel section. This procedure, Mr. Hen-

HERE'S A

Substitute Metal Finish

THAT COMBINES



- Extremely Hard, Smooth Surface
- Rust-Resisting Properties
- Cleanliness and Sanitation
- Durability and Economy
- Heat and Acid Resistance

Are you stymied by priorities on copper, brass, nickel, aluminum, stainless steel, galvanized steel or other non-corrosive metals? Then ING-RICH

Porcelain Enamel may be exactly what you are looking for. Outwears any organic finish 10 to 1. Advancements in the art of welding have done much to aid the designer-engineer in producing many porcelain enameled products that would have been considered impractical a few years ago. For rust resistance, a ground coat alone of ING-RICH Porcelain Enamel may suffice, thus reducing costs; and this coat may be applied in colors—black, blue, green, etc. Our engineers are at your service to show you the possibilities of porcelain enamel in your production. Two large job plants for handling your work. Write plant nearest you.

INGRAM-RICHARDSON MFG. CO., Beaver Falls, Pa.

INGRAM-RICHARDSON MFG. CO. of Indiana, Inc., Frankfort, Ind.

INGRAM-RICHARDSON

Porcelain Enamel

On the Assembly Line

(CONTINUED FROM PAGE 72)

type of product. E. R. Leeder, former resident manager of the Pontiac Fisher plant, is director of this section, with H. D. Burnside as assistant and Albert Haberer as chief engineer.

The Ordnance Specialties and Machine Section will be under direction of J. J. Wallbillich, assistant general factory manager of

fabricating plants. It will handle production of a large amount of Naval ordnance, including gun breech housings on which Fisher has been in production and received a Navy "E" award last August. This section also is producing a large quantity of vertical boring mills for use in tank manufacture. In addition, it will handle a greatly augmented program of production of engine parts for the Navy.

The Ternstedt division will make cutting tools to be used on airplane parts, gun parts and other armament work. J. W. Jackson, general manager, continues in charge of this division.

Fisher disclosed that his company, already engaged on the North American bomber sub-assembly program, is now turning out parts for other aircraft also. In the direction of the entire program, E. F. Fisher will be assisted by T. P. Archer as assistant general manager.



Strategy
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...a machine tool....or a gun mount

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for parts needing extreme wear resistance

When long life is an important factor in the selection of parts—when you must have a metal that can "take it"—your designing engineers can specify Ampco Metal with assurance that it will give maximum service life under the toughest conditions.

Ampco Metal is a special alloy series of the aluminum bronze class, available in six alloy variations. Of course, it has high physical properties and unusual tensile strength, but it also has controlled hardness and superior resistance to wear, corrosion and fatigue. It gives many times the service life of ordinary bronzes and is just the metal for that troublesome part that is weak or failing.

AMPCO LITERATURE Available

AMPCO METAL, catalogue 22
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Bearings
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When you need a *reliable* source of supply for that government contract—when you need better industrial bronzes for machine parts, submit your problems to Ampco engineers. We make bronzes to government specifications. Literature sent free on request.

AMPCO METAL, INC.

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AMPCO METAL

The Metal Without An Equal



INDICATION that General Motors will play a more important role in the aviation parts business comes from the election of Ernest R. Breech as president of Bendix Aviation Corp. In accepting the presidency, Breech has resigned from General Motors Corp., where he was vice president in charge of household appliances and aviation and a member of the administration committee, but it must be remembered that General Motors is an important stockholder in the Bendix firm. Breech's resignation from GM, while it severs one connecting link between Bendix and GM, still maintains certain important affiliations. Breech has been a director of Bendix and a member of the executive and finance committee during the past years in addition to his association as vice president of GM and chairman of the board of North American Aviation, Inc.

Mass Production of New Tank Begins

Washington

• • • Using cast steel and welded hulls to a much greater extent than the M-3, mass production of a new medium tank known as the M-4 for the Army has begun at a new Midwestern plant.

In announcing the start of production on the new tank, William H. Harrison, WPB director of production, said that it is the forerunner of thousands of tanks of similar design that will be built this year as part of the program for 45,000 tanks set by President Roosevelt as the 1942 goal. Other plants now turning out M-3 medium tanks shortly will begin making the M-4, with its new design, which, it was stated, will increase the effectiveness of its armament.

War Contracts Awarded

• • • Below is a list of government contracts recently awarded, some of which may require subcontract work. If you are interested in obtaining work on a subcontract basis, write, don't telephone, your nearest WPB Contract Distribution office. In making inquiries concerning any of the following items, please refer to the letters and numbers given in the second column.

Contract Item	Firm
Air compressors	NAF-1601
Lighters	NAF-1604
Compressors, air	NAF-1606
Tubes, stuffing	NAF-1607
Tubes, boiler	NAF-1703
Hammers	NAF-1704
Tubes, boiler	NAF-1705
Engines	NAF-1707
Combination pliers	NAF-1711
Cranes	NAF-1801
Cranes	NAF-1802
Parts, aeronautical	NAF-2001
Tracks	NAF-2002
Motor generator sets	NAF-2003
Tractors	NAF-2008
Pipe, conduit steel	NAF-2009
Benchers, tool	NAF-2010
Locomotives, diesel	NAF-2104
Cranes	NAF-2105
Clocks, deck	NAF-2109
Chain	NAF-2110
Truck cranes	NAF-2111
Engines, diesel	NAF-2112
Tractors	NAF-2113
Distilling units	NAF-2115
Instruments, electric	NAF-2116
Welding sets	NAF-2117
Machines, vegetable	NAF-2118
Co. machines, finishing	NAF-2122
Aviation collar devices	NAC-10101
Armature, coils, shunt, etc.	NAC-10104
Steel block straps	NAC-10107
Screws	NAC-10108
Universal milling machine	NAC-10109
Inspection gages	NAC-10111
Airplane instruments	NAC-10201
Ball bearings	NAC-10202
Oil burning range	NAC-10203
Steel bolts	NAC-10204
Steel pipe	NAC-10205
Surface gages, shaft levels, steel rules, etc.	NAC-10208
Ball bearings	NAC-10210
Copper	NAC-10305
Pipe & welding ells	NAC-10307
Lead foil	NAC-10308
Operating room lamps	NAC-10311
Ball bearings	NAC-10312
Electric copper wire	NAC-10402
Duplicator cutter, drill chucks, etc.	NAC-10406
Lenses	NAC-10408
Instrument & dressing stands	NAC-10509
Lanterns	NAC-10602
Protractors	NAC-10606
Reamers	NAC-10607
Automatic keying unit	NAC-10608
Vacuum pumps	NAC-10610
Sash fasteners, door hooks, etc.	NAC-10611
Protractors	NAC-10702
Cylinder to crankcase gasket, etc.	NAC-10703
Gyro compass repair shop equipment	NAC-10704
Hose clamps, detachable plugs, etc.	NAC-10709
Bins	NAC-10712
Rubber covered lead control cable	NAC-10802
Forceps	NAC-10803
Forceps	NAC-10804
Water heaters & spare parts	NAC-10808
Valves	NAC-10809
Screws	NAC-10810
Brass or bronze couplings & elbow	NAC-10901

Contract Item	Firm
Cloth, wire	NAC-10902
Outboard stern tube shaft	NAC-10905
Planes, rabbet & smooth	NAC-10906
Screws	NAC-10907
Metal cutting band saws	NAC-11004
Wood cutting planer	NAC-11005
Forceps	NAC-11010
Traps, spare valves, etc.	NAC-11011
Rods & bars	NAC-11012
Sphygmomanometers	NAC-11105
Coolers	NAC-11108
Drilling machine	NAC-11109
Tumbler, rotary type, shot blast	NAC-11110

Contract Item	Firm
Forceps	NAC-11111
Tubes, rectifier grid controlled, gas filled	NAC-11112
Refrigerating plant	NAC-11202
Steel forgings	NAC-11205
Industrial thermometers	NAC-11206
Heaters	NAC-11208
Caps & cap covers	NAC-10209
Milling machine	NAC-11210
Graflex identification units	NAC-11211
Alloy-mercury gages	NAC-11303
Sphygmomanometers	NAC-11401
Steel tap rivets	NAC-11405
Fog horns	NAC-11407
Exhaust fan & auxiliary equipment	NAC-11408
Nuts	NAC-11410
Spare bolts	NAC-11411

CUTTING OIL SERVICE THAT COUNTS



Stuart's
Thred Kut
for Tapping

Stuart's
SOLVOL
for turning
LIQUID CUTTING COMPOUND

Stuart's
"SUPER-KOOL"
BASE
for cold nosing

THE specialized cutting oil experience developed at pioneer war products plants provides a valuable working tool, immediately available to new government contractors.

For All Cutting Fluid Problems
D. A. STUART OIL CO.
Chicago, U.S.A. • LIMITED • Est. 1865
Warehouses in All Principal Metal Working Centers



(CONCLUDED FROM PAGE 117)

scrap in any of these ways must make all of his purchases at or below the ceiling prices, even though he also may be a dealer.

Q—Do provisions of Section 1309.69(d) dealing with mixed lots of scrap apply both to copper scrap and copper alloy scrap?

A—Yes. The paragraph in question applies to all kinds and grades of scrap covered by the schedule, except crucible copper scrap, and crucible copper alloy scrap. Unless the seller packs separate grades of scrap in separate containers or keeps them physically segregated in some other way, the entire shipment must be sold either (a) at a price not in excess of the maximum price established for the lowest price grade contained in the shipment, or (b) the buyer sorts the material at a price for

each grade contained which must be at least $\frac{1}{4}$ c. per pound below the maximum price established for each such grade. However, mixed shipments containing different grades, for each of which the same maximum price is established, must be sold at a price per pound at least $\frac{1}{4}$ c. below the established maximum price.

Q—When may a premium be paid for copper scrap in crucible shape or copper alloy scrap in crucible shape?

A—The premium for copper scrap in crucible shape or copper alloy scrap in crucible shape may be paid only if all of the following conditions are fulfilled: (a) The material meets the physical specifications set forth in Section 1309.69(g); (b) No quantity premium has been paid for the material; (c) The crucible shape material is physically separated from all other material.

Court Appointed for Price Order Appeals

Washington

• • • Set up to hear appeals from OPA price orders, Chief Justice Stone has named a three-man Emergency Court, headed by Judge Fred V. Vinson, associate justice of the District of Columbia Court of Appeals. Other members of the court are Justice Albert Branson Maris, Philadelphia, of the Third Circuit Court of Appeals and Justice Calvert Magruder, Baltimore, of the First Circuit Court of Appeals.

New Housing Critical List Is Issued

• • • A new Defense Housing Critical List has been issued. It is more specific than the original issued Sept. 19, 1941, which it supersedes and nullifies.

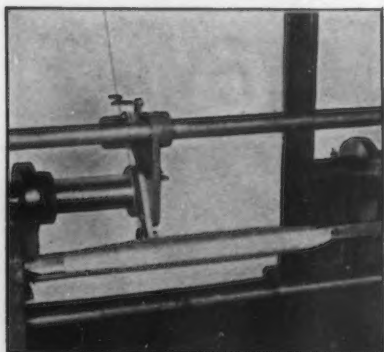
Preference ratings assigned to deliveries of scarce material for defense housing projects may be applied *only* to items appearing on the new critical list. Some major changes are:

Structural: Steel bearing plates are eliminated and steel stair construction is further restricted. Tin coating for sheet metal coverings on fire doors is eliminated. The use of metal lath is further curtailed.

Electrical: Armored cable, metallic cable, metallic raceways, and metal outlet boxes are allowed only where other methods are prohibited by the National Electric Code. Private telephone systems are prohibited.

Plumbing and Gas Distribution: Quantity and sizes of roughing-in materials are limited to meet the minimum requirements of the "Emergency Plumbing Standards" issued by the Defense Housing Coordinator, Dec. 26, 1941. Copper coils for hot water generators and heat exchangers are not allowed. Water softeners are allowed for single units.

Heating: Steam or hot water systems are allowed only for installations serving two or more families. Metal jackets for boilers are not allowed.



FIDELITY Quill Winder..

Accurate Taper Winding of Wire
for Weaving of Wire Cloth for
FILTERS • SCREENS • SIFTERS, etc.

The FIDELITY Quill Winder for accurate, high-speed taper winding of wire—six packages of uniformly even lay and taper at one time—speeds production for manufacturers of wire cloth for filters, screens, sifters, etc.

The taper is automatically governed by control buttons which reverse and successively shorten the traverse in the same operation.

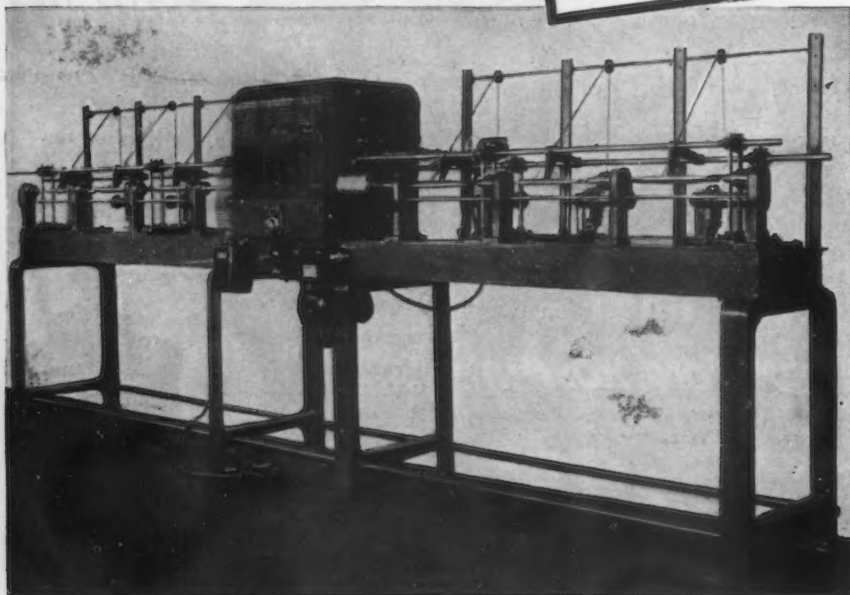
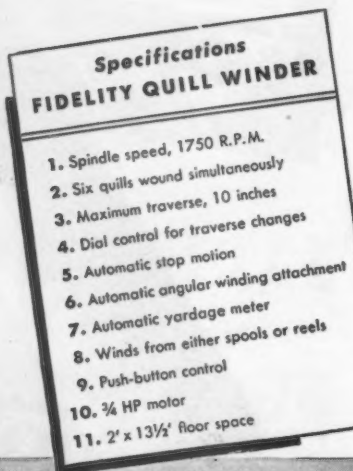
Slow acceleration prevents wire stretching and breakage. Other outstanding advantages include: hydraulic control, individual motor drive, tension control on feeder, and automatic stop motion and yardage meter.

You can wind wire from spools or brake-controlled reels depending on your requirements.

For further information and details, write to

FIDELITY MACHINE COMPANY

3908-18 Frankford Avenue, Philadelphia, Pa.



Telephone Engineering Practices Restricted

Washington

• • • Telephone engineering practices were restricted on Tuesday by WPB with the issuance of General Conservation Order L-50. Based upon recommendations recently made by the defense communications board, it is designed to save annually 29,000 tons of iron and steel, 35,500 tons of lead, 29,500 tons of copper, 650 tons of zinc and large amounts of other scarce materials needed in the war effort.

WPB's director of industry operations also on Tuesday announced revocation of the proposed assignment of a preference rating of A-9 for replenishment of stocks by warehouses handling copper and copper products.

At the same time, WPB announced it had raised from A-10 to A-8 the preference rating available for deliveries of materials to producers of spare parts for maintenance and repair of textile machinery and equipment in order to speed up Army and Navy work by the textile industry.

Crucible Earns \$7,439,480; Vanadium-Alloys, \$745,394

• • • Consolidated net profit of Crucible Steel Co. of America and subsidiaries for 1941 was \$7,439,480, equal after preferred dividend requirements to \$12.96 a share on common stock outstanding. For 1940, the net was \$6,083,257. Income from operations before taxes based on income was \$22,467,575, against \$10,031,386 for 1940. Federal income and excess profits taxes were \$14,797,787 in 1941, against \$3,681,746 in 1940.

Vanadium-Alloys Steel Co., during the last six months of 1941, showed a net profit of \$745,394, against \$906,620 in 1940. Provisions for federal and state income taxes and excess profits taxes totaled \$1,305,094. Net profit per share on 198,105 outstanding shares of stock totaled \$3.76.

Sharon Steel Corp. net earnings during the past year totaled \$1,633,364, against \$1,336,822 earned in 1940. Dividends during the year totaled \$5 per share on preferred stock and \$1 a share on common stock, excluding scrap equivalent to one share.

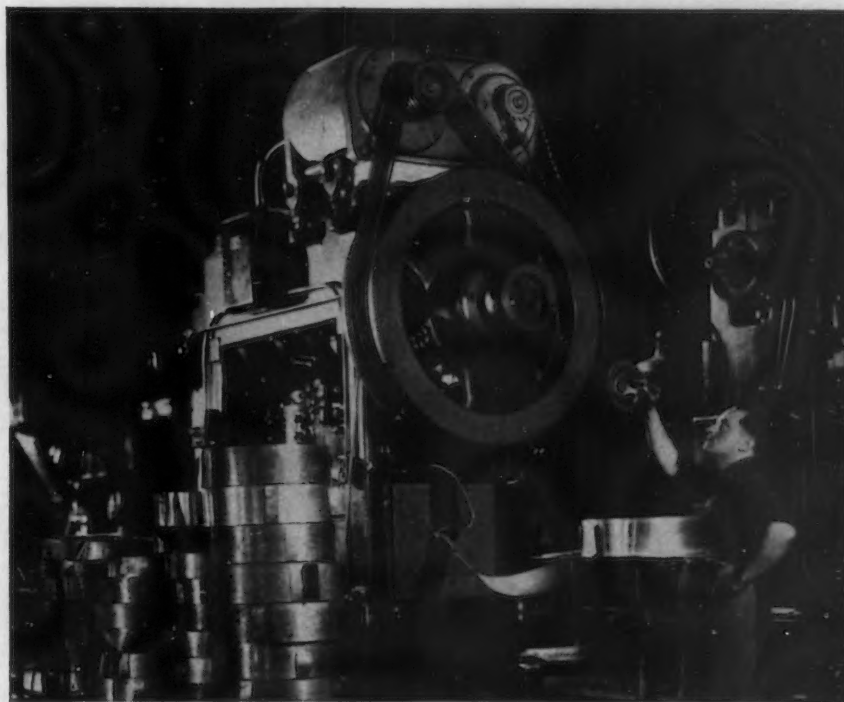
Three Pittsburgh Firms Suffer Labor Disputes

Pittsburgh

• • • Despite the no-strike agreement between labor and industry made several weeks ago, three Pittsburgh firms were shut down last week because of walkouts. Two plants have resumed operations while a third, employing about 200 men, is still shut down.

Operations resumed early this

week at Crucible Steel Co. of America, where more than 1000 SWOC members walked out last week in a demand for adjustment of grievances. Another CIO union walked out at the Pennsylvania Transformer Co. here last week in protest against the company's suspension of a union steward. This plant also resumed Monday. Early this week a strike at the P. Wall Mfg. Supply Co. over the demand for a 12½ per cent wage increase by the SWOC was still in progress.



NO TIME OUT FOR SPEED CHANGES

"Down time" is just as costly to our war production program when it occurs as a natural consequence of inadequate speed control, as when sabotage interrupts the flow of essential production.

We have no time to spare now changing belts and gears, when speeds can be regulated by the simple operation of turning the handwheel of a REEVES Variable Speed Drive, without stopping the machine. If you have a machine in essential production which is not doing its best on account of inflexible speed operation, write, wire or phone us. We build many different sizes of three basic speed control units, thus assuring the correct unit for your individual requirements. Send for copy of new 20-page booklet, "More Output For Defense," which gives 26 helpful examples.

REEVES PULLEY CO., Dept. I, COLUMBUS, INDIANA

REEVES

Accurate • Variable
SPEED CONTROL

War Output Seen Slowed By Changes in Priorities

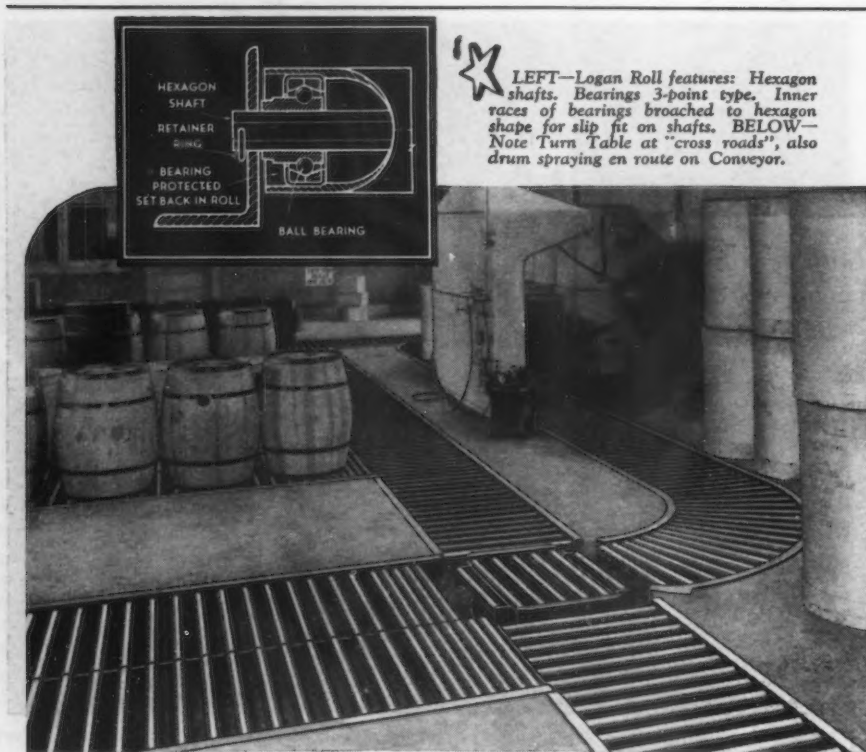
...Paced by the plea of WPB Chief Donald M. Nelson for the "greatest production drive in history," the conversion of peace time industry to war production has been sharply speeded up over the past week. This trend is highlighted by

the large number of orders limiting or curtailing production of non-essential goods issued by WPB lately.

At the same time many industrial executives are voicing complaints over the continuous changing of

priority regulations and procedures. They report that these changes are seriously hampering the flow of materials into their plants. In contrast with Nelson's statement that present production could be increased 25 per cent with existing equipment, plant managers report that confusion over the operation of priorities is actually slowing production.

A description of how to use the new priority forms PD-1A and PD-3A is given on page 125.



When you **CONVERT-CONVEY!**

THAT is industry's new slogan. For mechanical handling, by conveyor, helps get the job done, and out "on time and right" to meet the nation's needs. How do you handle incoming materials, work in process, parts through assembly, finished products to shipment? Study these major moving points for time-and-effort-saving possibilities. Put flow into your new war production, now. Write for nearest Logan Conveyor engineer or for pertinent literature. LOGAN, 545 Cabel, Louisville, Ky.

Logan Conveyors

PUT FLOW INTO PRODUCTION

Typical of these protests is the statement of E. P. Kastien, purchasing agent of R. G. Le Tourneau, Inc., Peoria, Ill., that unless the present red tape is removed his firm would find it futile to attempt to fill its war contracts. The company is engaged 100 per cent on war work, with about 75 per cent of its orders rated A-1-a. Yet, Kastien reported, it has been forced to lay off about 400 employees, with the prospect to cutting off more, and has two production lines down completely due to the lack of steel and other materials.

"Unless we are supplied with materials that are needed, we will be forced to refuse to make out any more reports, for whatever is done today will be superseded by some half-baked plan or interpretation tomorrow, automatically relegating what was previously prescribed to the ashcan," Kastien said.

Similar reports of confusion over the number of changes in priority orders have been received from New England. It is reported that the full six-day week is not yet universal in that area and efforts to expand munitions output have been hampered by inability to obtain necessary materials.

The problem of eliminating the steady flow of changes in priority regulations is made more complex by the fact that a large number of the revisions reflect efforts of WPB to correct inequities existing in the original form of the order.



Steel Mill Given Rating For Office Equipment

... Use of an A-10 rating is allowed producers of iron and steel products for obtaining office supplies and similar material under the terms of Amendment No. 2 to

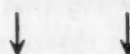
order P-68, issued last week by WPB. Previously P-68 preference ratings were applicable only for material to be used in the actual production of iron and steel products.

The basis for inventory restriction in Order P-68 has been shifted by the amendment from a 1940 base period to the most recent calendar half year, and the percentages which may be applied to the base period to measure current receipts and withdrawals have been slightly increased. The order, which was scheduled to expire June 30, 1942, will continue in effect as amended until revoked.



Can Shipments Permitted

• • • WPB's Containers Branch has announced that deliveries of tin cans for home or institutional canning purposes are not barred by provisions of order M-81. Manufacturers are permitted to sell home-canning type cans to hardware stores and other distributors buying for resale to home or institutional canners.



Pipe Fittings Simplified

• • • Simplification of pipe fittings has been ordered by WPB in Schedule 2 of Limitation Order L-42 covering plumbing and heating equipment. Schedule I, issued Feb. 11, required simplification of iron, brass, and bronze valves. The pipe fittings schedule, in its entirety, has already been issued as a simplified practice recommendation by the Department of Commerce Bureau of Standards under No. R185-42. Reduction under this program of the number of fittings in current use from more than 8500 to less than 3000 will satisfy 92 to 94 per cent of all demand, according to the Plumbing and Heating Branch of WPB.

After March 1, grey cast iron, malleable iron, or brass, or bronze pipe fittings not conforming to the established schedule may not be produced, except with the express permission of the Director of Industry Operations.

L-6-b Quotas Extended

• • • WPB has issued an order, L-6-b, extending to March 15 the February quotas for the manufacture of domestic laundry equipment. Under the extensions, the same rate of production is permitted for the first half of March, the number of units permitted being half that of the February

quotas because it covers only half of March.



Warehouse Order Revised

• • • By the terms of Amendment No. 3 to supplementary Order M-21-b, issued last week by WPB, steel warehouses are prohibited



Therm-O-flake INSULATION BRICK

One of lightest insulation brick available—(about one pound each).

Has low thermal conductivity, and is most economical for efficient insulation.

Can be compacted without breaking and cuts easily. Especially valuable for back up work behind fire brick walls.

Acts as expansion cushion between furnace walls and binding structure.

Write for Information and Prices

other **Therm-O-flake** Products

Made from Exfoliated Vermiculite

Granules - Brick - Block - Concrete



JOLIET, ILL.

from accepting deliveries of steel in excess of their assigned quotas.

The restrictions previously imposed by the order applied only to deliveries from steel producers. The chief purpose of this amendment is to prevent warehouses from obtaining deliveries of products listed in Schedule A of the order in excess of quotas from other sources.


The order has also been amended

to permit warehouses to accumulate preference ratings higher than A-9 on deliveries to their customers up to 90 days so that they may place with their suppliers an order for a minimum commercial quantity. However, any steel obtained by a warehouse through extension of a rating higher than A-2 may not be delivered by the warehouse to any customer except on orders which bear


a rating higher than A-2 until such stock has been held at least 90 days.

An amendment to the order enables small warehouses to buy steel products listed in Schedule "B" in minimum carload lots, notwithstanding the restrictions on quarterly deliveries, provided the warehouse does not accept deliveries of its total annual quotas.

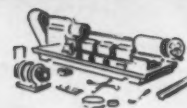
Wire rope has been omitted from the schedules of products to which quotas may be assigned.




—prepare government proposals and estimates




—determine most efficient methods of production



—convert present equipment to new requirements



—lay out plants, select and buy machinery



—design new tools, gages, and fixtures

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Tool Makers to Use PRP

• • • Cutting tool manufacturers have been advised that after June 30 they must use the Production Requirement Plan (P-90) to obtain priority assistance. Order P-18-a, under which the cutting tool industry has been entitled to use a rating of A-1-a, has been extended to July 1, but will be allowed to expire on that date.

All manufacturers who have been operating under P-18-a are advised by WPB to submit application form PD-25a under PRP.

Expect New Pig Iron Forms

• • • Pig iron observers in Pittsburgh believe Washington is preparing new forms for customers' requests for allocation. The reason for this is that pig iron orders continue to climb into the higher rating groups so that it will be necessary for Washington to have a breakdown of the A-1 to A-9 group in order to make allocations of April shipments.

Black Plate Output Cut

• • • The position of black plate for tin and terne plate was clarified temporarily last week when WPB advised steel companies that as much black plate as could be coated could be produced. Interpreted, this apparently means that uncoated black plate production, except that having ratings, is out of the picture. It is expected a new order clarifying uncoated black plate production will be out soon and may restrict uses to those products listed in Tables 1, 2, and 3 of the recently issued can order.

How to Use Priority Forms PD-1a, PD-3a

Washington

••• Answers to some of the problems arising from the changeover from the use of priority forms PD-1, 2, 3, 4, and 5 to the new forms PD-1a and PD-3a are presented herewith. The answers were prepared by WPB.

Applications for priority ratings for any material which cannot be obtained without a rating and which is not already covered by a specific priority order must be made on priority form PD-1a. Ratings for materials used for Army and Navy for other specified government agency contracts are applied for on form PD-3a. Obviously, materials for non-essential products cannot be obtained on any form, but for essential civilian needs not covered by a specific order, the PD-1a form is employed.

The form PD-1a replaces the older forms PD-1 and PD-2, while the new PD-3a replaces PD-3, PD-4 and PD-5. Use of the new forms became permissive on Feb. 1, but will be mandatory on March 15. Previously use of the new forms was to become mandatory on Mar. 1, but last week WPB announced that the deadline had been set back to March 15. In the meantime, industry is urged to make use of the new forms as early as possible.

Copies of form PD-1a are available from the Reader Service Department of THE IRON AGE, 100 East 42nd Street, at 5c. a set. A set consists of the original, duplicate and triplicate copies and an information sheet. Form PD-3a cannot be reproduced, except for information purposes only.

Q. Do I have to make out a separate PD-1a application form for every order to be placed with each of my suppliers?

A. Only when you are ordering different kinds of supplies or supplies to be used for different purposes. If you are assigned a rating to cover 100 tons of steel which is all to be used for the same purpose, you may use the rating on orders for 50 tons from one company, 25 tons from each of two others, etc. You may not use it, however, to obtain a larger total quantity than the amount approved on the certificate. If you need 50 tons of steel for one product and an additional 50 tons for another product, you must make out two separate applications.

Q. May I use the PD-1A to apply for a rating on construction work?

A. No. For construction, a project

application should be filed on forms PD-200 and PD-200a. If the project is to be built for the Army or Navy or for a prime contractor under an Army or Navy contract, the application should be filed with the contracting officer in the field.

Q. May I use a PD-1a form to apply for a rating on a machine tool?

A. PD-1a applications may be made for machine tools or other capital equipment if their use does not involve any physical expansion of your plant. When it is necessary for you

to enlarge your plant to accommodate additional tools, you should apply for a project rating for the expansion and a rating for the required tools in an accompanying letter.

Q. What do I do with the PD-1a form when it is returned to me with a rating assigned by WPB?

A. Keep the approved form in your file and apply the rating by endorsement on your purchase order. You do not need to send either the original or a copy to your suppliers as you did with the old PD-1 forms.



• Under-Running Single Beam Crane handling sheet steel grab.

• Bulletin No. 130 shown above is packed full of informative data on over-running, inner-running and under-running single beam cranes. A copy is yours for the asking.

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Lift
THERE'S A SHEPARD NILES
CRANE OR HOIST TO DO IT!**

In every industry, Shepard Niles Single Beam Cranes are smashing bottle necks and unraveling production snarls. They provide every process that needs a lift, with economical day-in and day-out service, 365 days a year. All along the production line—wherever you need a lift—there is a Shepard Crane or Hoist of the exact type and capacity for the job.

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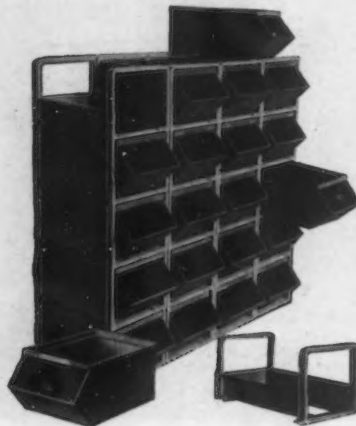
EXPAND STORAGE FACILITIES... OVERNIGHT!

With the Stackbin System's portable units you can expand storage facilities and speed up the flow of parts and materials... overnight—as many plants flooded with war orders have already done!

Stackbin units fit into any spot—in stockrooms, under benches, near machines. Can be placed within easy reach of assemblymen. They save production time because parts can be found at once without piling and unpling boxes; because parts do not need to be transferred from bin to tote pan and back to bin again. Get complete details! Write for "LOWER COST STORAGE AND HANDLING". Stackbin Corp., 89 Troy St., Providence, R. I.

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Is this combination of Stackbins-in-Stackracks. Parts and materials are transferred from one department to another, are used or processed and passed along in their storage container. No waste time—less loss, less damage.



STACKBINS

are individual hopper-fronted storage bins—with perfectly smooth interiors—which nest to form work units and slide in Stackracks like drawers for storage.

STACKRACKS

are individual racks of heavy steel—made in any size you need. Locking together without tools, they make a strong, rigid storage rack of any capacity, height or shape you want.

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as sectional book-cases, nested Stackbin sections provide temporary storage space wherever needed. Many modern plants use them as room- or departmental storage "depots".



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permit Stackbin Assembly Bins to feed parts continuously towards the front of the bin. Tapered front design provides semi-circular set-up, so that all parts are within easy reach.

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SYSTEM

STACKBIN CORPORATION

89 Troy St., Providence, R. I.

PRIORITIES

How to Use PD-3a

Q. Is the Army or Navy required to give me a PD-3a certificate when they place an order with me?

A. No. Preference ratings are not usually assigned to certain classes of materials and the Army and Navy may refuse to assign ratings when they consider the assignments unwise.

Q. Will preference ratings be granted on Form PD-3a for materials not listed on the Army and Navy Priorities Critical List?

A. Yes. The Army and Navy priorities critical list has been abolished as a limiting factor for the issuing of preference ratings by field officers.

Q. Can PD-3a be used to assign ratings for construction or expansion of plants?

A. The only construction work which can be covered by PD-3a certificates is that which will be owned by the Army or Navy upon completion. Prime contractors building or expanding a plant exclusively for the production of goods to be delivered to the Army or Navy should make application on forms PD-200 and PD-200a to the Army or Navy officer concerned, who in turn will forward it to the Army-Navy Munitions Board for approval. Other project rating applications should be made directly to the War Production Board.

Q. May PD-3a certificates be issued for machine tools or other capital equipment?

A. Yes, under certain circumstances. You should get in touch with the local contracting, procurement or inspecting official of the Army or Navy who, through proper channels, may request the higher rating.

Q. May PD-3a be used for repair, maintenance and operating supplies?

A. Yes, if you are a prime contractor or for the Army or Navy or a subcontractor whose dollar volume of orders on hand is 50 per cent or more in Army or Navy contracts. Subcontractors will not be permitted to use PD-3a's for repair, maintenance and operating supplies after June 1. If you are a subcontractor, it would be best for you to apply for preference ratings under the Production Requirements Plan (order P-90).

How to Extend Rating

Q. Must the endorsement by which I extend PD-1a and PD-3a be on the actual purchase order?

A. It must be sent as a part of the purchase order, but a separate form may be printed and attached to the purchase order to carry the properly signed endorsement.

Q. May I extend a PD-3 which I have received, by the procedure described for PD-3a?

A. After March 15, previously issued PD-3's must be extended by the procedure described for PD-3a. Until March 15, PD-3 should be extended only by the PD-3 procedure unless the cost of material to be processed is under \$500, in which case extension by endorsement has been authorized.

Q. May I extend a PD-1 by the procedure which has been described for PD-1a?

A. No.

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PRIORITIES

Q. May I extend a rating received on a "P" order in the manner described for PD-1a and PD-3a?

A. Not unless the order concerned specifically provides for that kind of extension.

Q. May a PD-3a be used to assign a rating to materials to be purchased in accordance with a Letter of Intent?

A. Yes. PD-3a may be issued by Army and Navy officials on the basis of an Army or Navy Letter of Intent.

Q. May I extend a rating received on a PD-1a certificate and a PD-3a certificate on the same purchase order?

A. Yes. Any number of PD-1a and PD-3a certificates carrying the same rating may be extended on the same purchase order.

How to Reproduce Forms

Q. May I reproduce forms PD-1a and PD-3a?

A. PD-1a is an application form, so it may be reproduced if the reproduction is exact. PD-3a is a certificate used by designated Government officials. It may not be reproduced except for informational purposes when clearly marked "Specimen."

Q. What is a practical working minimum?

A. A practical working minimum means the smallest inventory which will enable you to keep your production processes operating efficiently. Unless the circumstances are exceptional, this should not be more than a three-months supply, or more than the amount of inventory you had on hand a year ago. In the case of certain scarce materials, maximum permissible inventory has been specifically prescribed by the War Production Board.

Q. What is meant by a single kind of material for which a separate PD-1a application must be filed?

A. Materials included on a single PD-1a application must fall into one common class such as steel, paper, etc. One application may cover several sizes and shapes of steel products, or several items of any other single type or material.

Q. What is meant by a single need or use for which a separate PD-1a application must be filed?

A. A single need is for a specific quantity of materials to be used in making one product or class of products. A single use is for one or more items of equipment or supplies to be used for a single purpose as described in the application.

March Lead Pool Higher Washington

The March lead pool on Monday was set at 15 per cent of January, 1942, production, in Order M-38-f, issued by WPB. While the percentage is unchanged from last month, the actual amount of metal set aside for specific shipments is larger, since the base period is changed from December, 1941, to January, 1942.

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No. 4B
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High Speed Saw



No. 6A
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Automatic Production Saw with
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No. 18
Capacity 18"x18"
"Giant" Hydraulic
Hack Saw handles
toughest alloy
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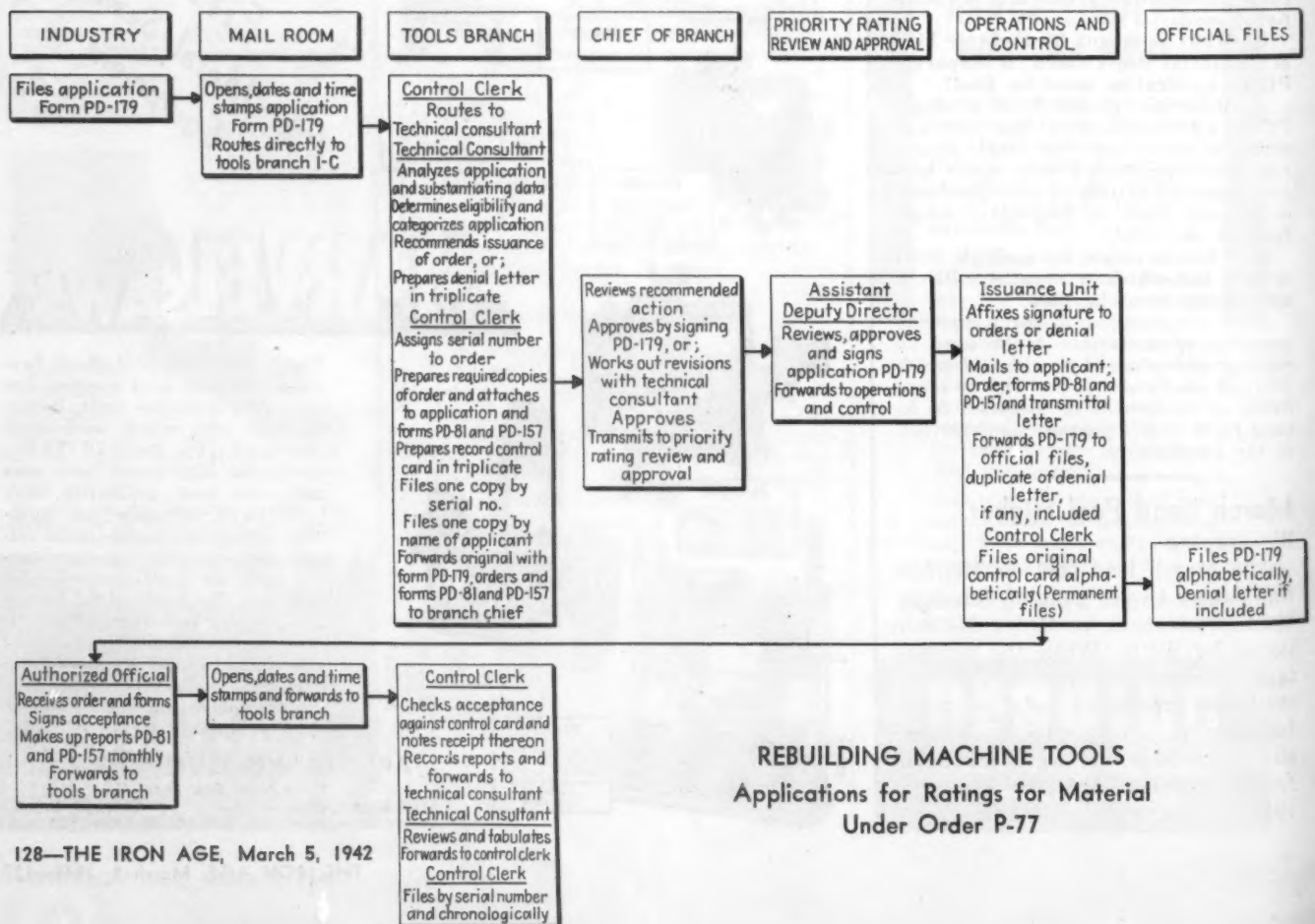
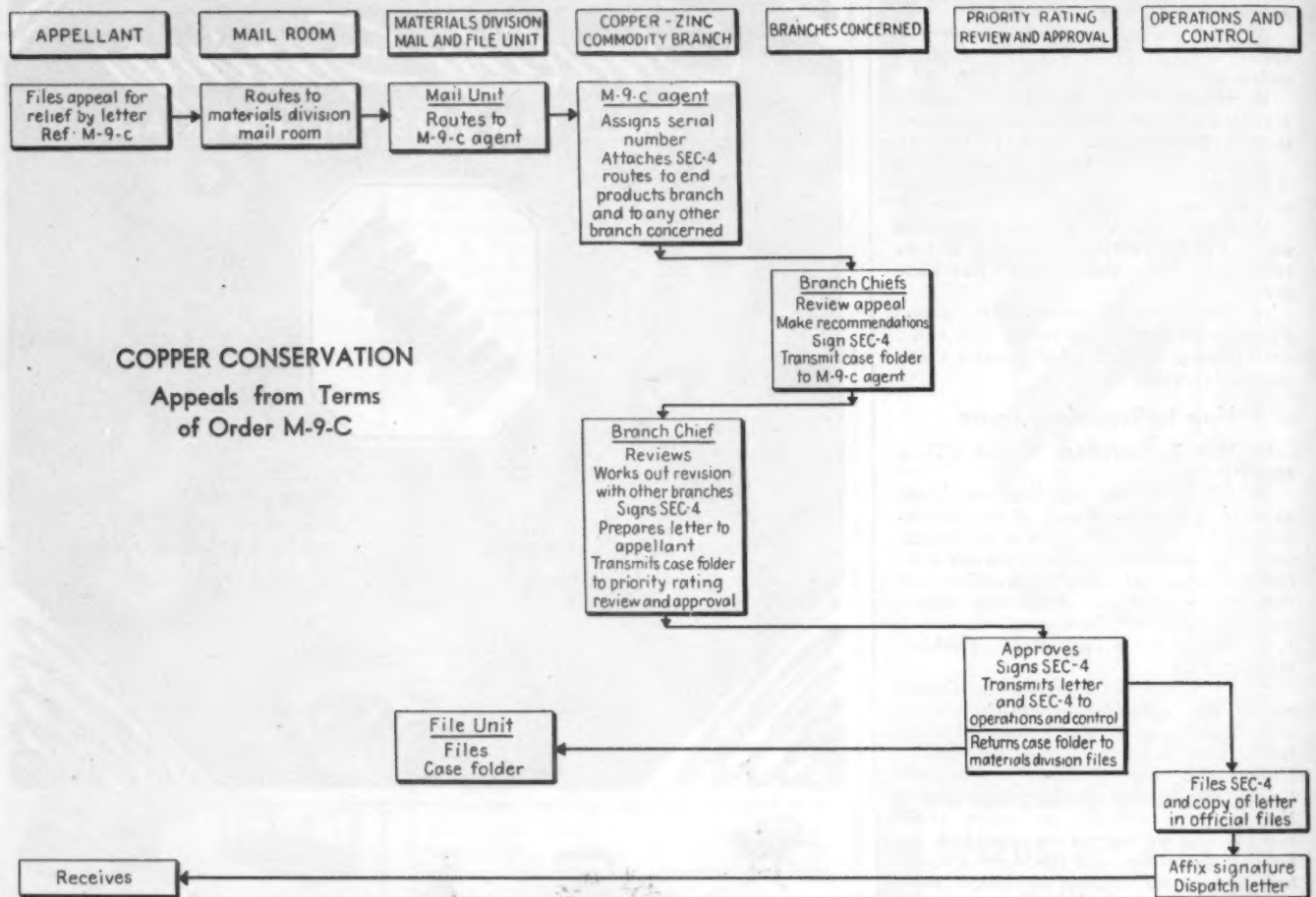
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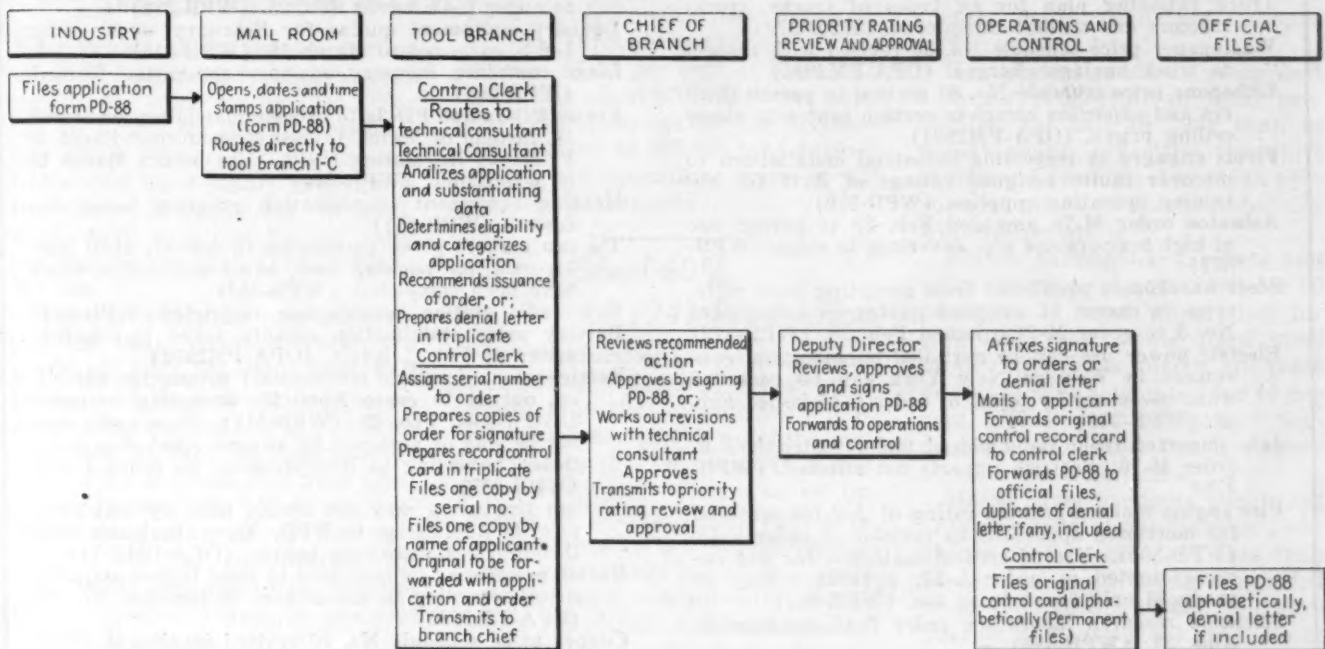
How Priority and Allocation

(These four flow sheets show steps taken considering requests for priority ratings)

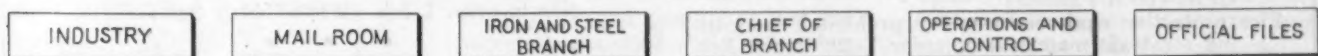
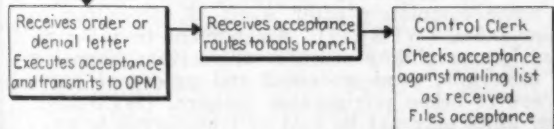


Applications Are Handled

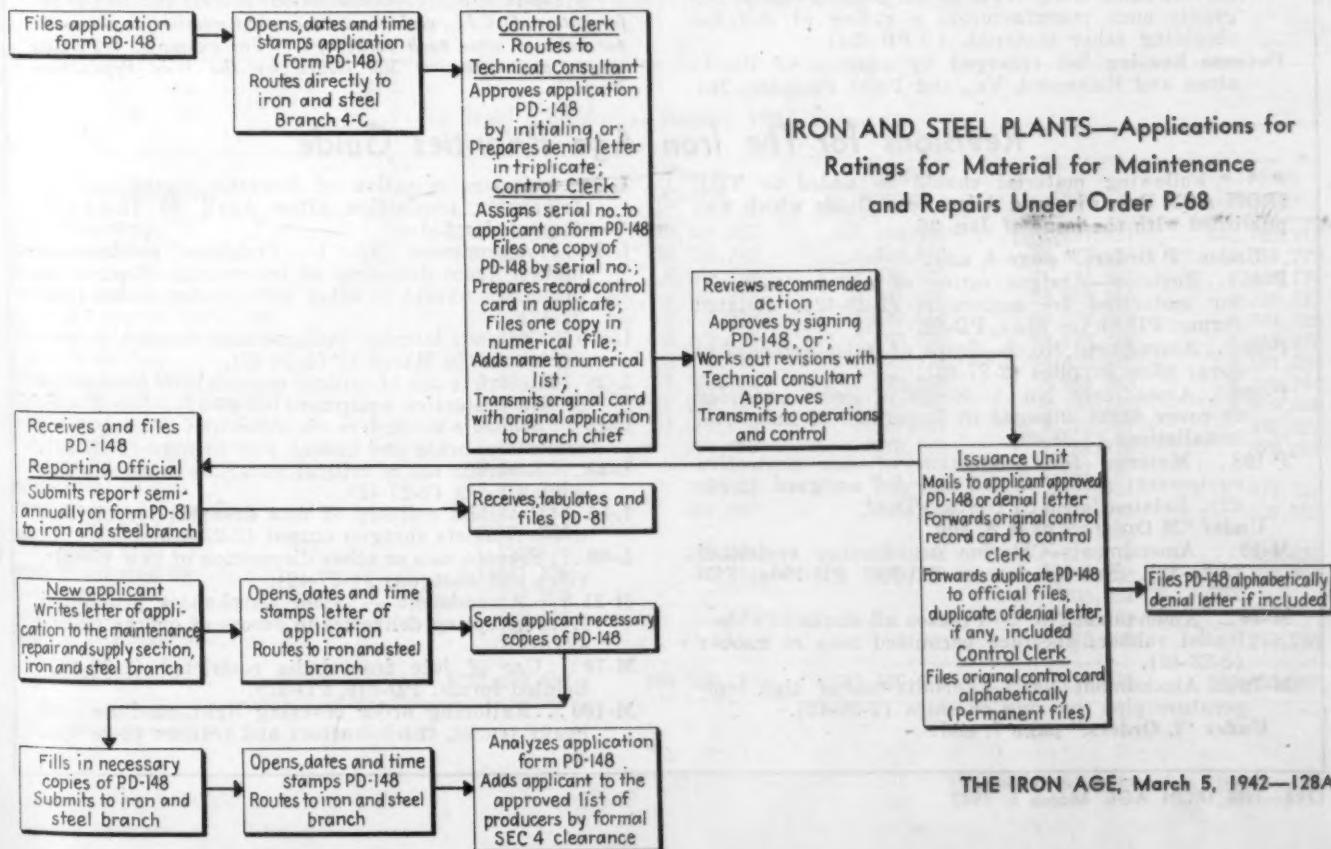
by War Production Board branches when
or appeals from several typical orders.)



METAL WORKING EQUIPMENT—Applications for Rating for Material Under Order P-11-A



IRON AND STEEL PLANTS—Applications for Ratings for Material for Maintenance and Repairs Under Order P-68



This Week's Priorities and Prices

Aluminum users requested to sell excess supplies to Metals Reserve Co. (WPB-328). Such purchases by the government will be exempt from provisions of aluminum price schedule No. 2. (OPA-PM2601)

Truck rationing plan for all types of trucks, truck-tractors and trailers announced. (WPB-379)

Wastepaper price schedule No. 30 revised with respect to truck haulage charges. (OPA-PM2588)

Lithopone price schedule No. 80 revised to permit dealers and exporters complete certain contracts above ceiling prices. (OPA-PM2591)

Firms engaged in inspecting industrial installations to discover faults assigned ratings of A-10 for obtaining operating supplies. (WPB-370)

Asbestos order M-79 amended Feb. 28 to permit use of high temperature pipe coverings in ships. (WPB-371)

Steel warehouses prohibited from accepting steel deliveries in excess of assigned quotas in amendment No. 3 to order M-21-b issued Feb. 28. (WPB-372)

Electric power use can be curtailed by industrial consumers in Western New York can be curtailed when necessary by terms of order L-46 issued Feb. 28. (WPB-376)

Jute imported from India placed under restrictions in order M-70. Scottish imports not affected. (WPB-378)

Fire engine makers granted rating of A-2 for material for motorized apparatus by revision of order P-45. (WPB-300). Use of critical materials for fire engines limited in order L-43; apparatus may be produced only for defense use. (WPB-365)

Scientific research laboratory order P-43 extended to Aug. 31. (WPB-382)

Cutting tool makers must use Production Requirements Plan (order P-90) to obtain priority assistance after July 1. (WPB-383). Cutting tool order E-2-a extended indefinitely. (WPB-369)

Rifle and shotgun manufacturers asked to stabilize prices at Jan. 10 levels. (OPA-PM2570). Retail sales of new pistols, rifles or shotguns by other than a manufacturer prohibited in order L-60. (WPB-377)

Non-ferrous metal prices to be discussed in series of OPA regional meetings in South and West. (OPA-PM2575)

Brake shoe price increase withdrawn at request of OPA. (OPA-PM2569)

Fire protection equipment makers prohibited from using strategic materials in order L-39, issued Feb. 24. At same time, WPB issued order P-108 which grants such manufacturers a rating of A-7 for obtaining other material. (WPB-354)

Defense housing list enlarged by addition of Blackstone and Richmond, Va., and Point Pleasant, Md.

(WPB-361). New material critical list issued. (WPB-368)

Plumbing and heating equipment pipe fitting design and manufacture ordered simplified by amendment to order L-42 issued Feb. 25. (WPB-339)

Laundry equipment quotas for February, under order L-6-b, extended to March 15. (WPB-346)

Glass container industry advisory committee formed. (WPB-347)

Forms PD-1a and PD-3a to become mandatory on March 15, instead of March 1, according to amendment to Priorities Regulation No. 3. Use before March 15 is permissible. (WPB-348)

Heating equipment simplification program being discussed. (WPB-351)

Tin can makers given permission to deliver, until May 31, cans for packing beer, hams and coffee which have been completed. (WPB-353)

New radio station construction restricted. (WPB-334)

Battery price stabilization makers asked to stabilize prices at Feb. 1 levels. (OPA-PM2552)

Refrigerator (domestic mechanical) production curtailed, output to cease April 30, according to order L-5-c issued Feb. 23. (WPB-317). New units may not be sold or assigned by anyone other than a retailer, according to interpretation to order L-5-b. (WPB-355)

Civilian tire users may not obtain tires by making a priority application to WPB. Tires obtainable only through local rationing boards. (OPA-PM2574)

Burlap prices may be increased to meet higher shipping costs, according to amendment to schedule No. 18. (OPA-PM2582)

Copper price schedule No. 20 revised in several minor details on Feb. 27. (OPA-PM2589)

Steel and iron industry assigned A-10 rating for obtaining office supplies in amendment to order P-68. (WPB-359)

Chlorine use further curtailed in amendment to order M-19 issued Feb. 25. (WPB-362)

Mechanical refrigerator production curtailed; output to cease completely after April 30, according to order L-5-c. (WPB-317). Amendment to L-5-c issued later prohibits manufacturers from disposing of materials, semi-processed and processed parts except to other refrigerator makers. (WPB-374). New units may not be sold or transferred to anyone other than a retailer, according to interpretation to order L-5-b. (WPN-355)

* * *

For copies of above announcements address Division of Information, O.E.M., giving announcement number as shown in parentheses after each paragraph. (For example, WPB:300 means announcement 300 issued by the War Production Board.)

Revisions for The Iron Age Priorities Guide

• • • Following material should be added to THE IRON AGE Priorities and Allocations Guide which was published with the issue of Jan. 26.

Under "P Orders," page 4, add:

P-45... Revision—Assigns rating of A-2 for material for motorized fire apparatus (2-28-42). Related forms: PD-81 (or 81a), PD-82.

P-68... Amendment No. 2—Scope of order extended to cover office supplies (2-27-42).

P-100... Amendment No. 1—Scope of order extended to cover firms engaged in inspection of industrial installations (2-28-42).

P-108... Material for production of fire protective equipment; rating of A-3 and A-7 assigned (2-26-42). Related forms: PD-81a, PD-82.

Under "M Orders," page 8, add:

M-19... Amendment—Chlorine use further restricted (2-25-42). Related forms: PD-190, PD-190a, PD-277.

M-46... Amendment No. 1—Freezes all stocks of chlorinated rubber; specifies permitted uses of rubber (2-23-42).

M-79... Amendment No. 1—Permits use of high temperature pipe covering on ships (2-28-42).

Under "L Orders," page 7, add:

L-5-c... Orders cessation of domestic mechanical refrigerator production after April 30 (2-23-42). *Supersedes L-5-a.*

L-5-c... Amendment No. 1—Prohibits refrigerator makers from disposing of inventories of parts or materials, except to other refrigerator makers (2-27-42).

L-6-b... Extends laundry equipment production February quotas to March 15 (2-24-42).

L-39... Restricts use of critical materials in production of fire protective equipment (2-24-42). See P-108.

L-42... Schedule 2—Orders simplification of gray iron, malleable, brass and bronze pipe fittings (2-25-42).

L-43... Restricts use of critical materials in certain fire engine parts (2-27-42).

L-55... Prohibits delivery of new firearms for civilian uses; restricts shotgun output (2-23-42).

L-60... Freezes sale or other disposition of new pistols, rifles and shotguns (2-27-42).

M-21-b... Amendment—Steel warehouses prohibited from accepting deliveries in excess of quotas (2-28-42).

M-70... Use of jute from India restricted (2-27-42). Related forms: PD-318, PD-319.

M-100... Rationing order covering light, medium and heavy trucks, truck-tractors and trailers (2-28-42).

Steel Industry Profits Show Gain from 1941

• • • Profits of the steel industry, as could be expected under present conditions, were up in 1941. For the 20 producers listed, representing about 90 per cent of the nation's steel ingot capacity, net profits totaled \$278,628,467 in 1941, while 1940 earnings by the same companies amounted to \$251,211,641.

The seven leading producers reporting 1941 earnings, showed a profit of \$238,784,599, about 85.7 per cent of the earnings of the reporting companies, and the 20 firms reporting showed an average net gain of 9.8 per cent over 1940 profits. However, the top seven producers showed an average net gain of only 6.8 per cent during the year, while earnings of the remaining 13 producers were 28 per cent over 1940 reports.

Federal taxes, normal and excess profits, during the past year reached an all-time high, and are likely to continue on the up-grade during the coming 12 months. While the total earnings of the seven leading companies are relatively large, tax provisions by these firms are in excess of the profits. During 1941, reserves for taxes by this group totaled \$330,188,000, some \$91,347,000 greater than the profits.

As reported by the American

Iron and Steel Institute, operations during the past year reached a new all-time high, with the industry working throughout the year at an average of 97 per cent of capacity, producing about 82,927,500 net tons of steel ingots, against the production of some 65,900,000 tons during 1940 when operations were at 82 per cent of capacity.

Heavy Steel 60% of 1941 Production

• • • Production for sale of semi-finished and finished rolled steel products in 1941 established a new record of 65,362,000 net tons, according to the American Iron and Steel Institute. That was an increase of nearly 35 per cent over the previous record, 48,585,000 net tons, established in 1940. Some of the total undoubtedly represents reduction of inventories of ingots and semifinished products carried over from the previous year.

In the production of individual steel products, more records now standing were made in 1941 than in any previous year. With the exception of rails and certain varieties of pipe, new peaks were established for nearly every major class of steel product.

Among the products manufactured in record quantities last year were sheets and strip, tin plate, alloy bars, concrete reinforcing

bars, and sheet piling. Records were also almost certainly made in plates, heavy structural shapes and merchant bars.

Heavy steel products comprised a larger proportion of total production for sale in 1941 than in recent years, reflecting the shift in demand from steel to make consumers' goods to steel needed for war equipment.

Plates, shapes, bars, billets and other heavy steel accounted for 60 per cent of total production for sale last year, while light steel products such as sheets, tin plate and wire rods accounted for 40 per cent. This was the largest percentage accounted for by heavy products in nine years.

Heavy steel products comprised 58½ per cent of the total in 1940, 55 per cent in 1939 and less than 54 per cent in 1938. In the period from 1933 through 1935, the production of heavy steel products at times comprised as little as 52½ per cent of the total.

Bridge Yielded by Man in Scrap Drive

East Liverpool, Ohio

• • • The local scrap drive has been given a boost by T. H. Fisher, bank president. He donated a 30-ton steel bridge, built in 1880 and purchased by him for sentimental reasons.

20 Steel Companies Report 1941 Earnings

Company	1941	Fourth Quarter	Third Quarter	1940	Fourth Quarter
U. S. Steel Corp.	\$116,019,518	\$20,331,427	\$34,313,345	\$102,181,321	\$32,793,212
Bethlehem Steel Corp.	34,457,796	10,459,742	7,910,569	48,677,524	14,516,779
Republic Steel Corp.	24,038,340	6,041,244	4,378,379	21,113,507	8,480,174
National Steel Corp.	17,102,350	4,180,078	4,411,466	15,066,340	4,225,212
Jones & Laughlin Steel Corp.	16,274,983	4,234,599	3,942,157	10,277,029	4,044,126
Youngstown Sheet & Tube Co.	16,124,000	3,678,158	3,103,649	10,815,468	5,549,976
Inland Steel Co.	14,824,053	3,576,711	3,675,724	14,450,385	2,561,901
Wheeling Steel Corp.	8,506,304	1,943,753	1,873,355	5,685,848	2,388,744
Crucible Steel Co. of America	7,439,480	2,250,151	1,994,169	6,230,180	2,859,682
Allegheny-Ludlum Steel Corp.	5,062,709	1,073,473	1,547,784	3,772,107	940,822
Colorado Fuel & Iron Corp.*	3,615,560	806,450	679,164	2,288,318	320,064
Midvale Co.	3,304,050			3,227,737	
Acme Steel Co.	3,166,346	762,836	761,154	2,127,444	479,352
Rustless Iron & Steel Corp.	2,332,298	662,097	545,750	1,275,993	508,653
Lukens Steel Co.†	2,195,604			709,488	
Continental Steel Corp.	1,225,674	293,524	294,592	778,738	286,631
Alan Wood Steel Co.	1,051,772	35,504	259,153	1,210,202	369,705
Detroit Steel Corp.	819,968			708,824	
Scullin Steel Co.	588,415			299,929	
Granite City Steel Co.	479,247			315,259	213,234
Total	\$278,628,467	\$60,328,747	\$69,690,410	\$251,211,641	\$80,538,267

* Fiscal year ends June 30.

† Fiscal year ends Oct. 11.

Output of Plates, Shapes, Bars Rises in January

• • • Total steel production for sale in January rose to 5,567,539 net tons, from 5,527,210 tons in December, according to the report of the American Iron & Steel Institute. In January, 397,172 tons of the above total went to members of the industry for conversion, against 382,814 tons in December.

Steel plate production rose to

713,182 tons in January, compared with 635,812 tons in December and a monthly average of 502,250 net tons in 1941. Output was at the rate of 118.2 per cent of plate mill capacity, against 106.6 per cent for all 1941. The plate production figures all indicate wider use of strip mills for plate output.

Structural shape output rose to 403,215 tons in January, against

368,773 tons in December; merchant bar production rose to 593,129 tons from 557,446 tons in December.

Among products showing declines, cold reduced tin plate output fell to 279,905 tons from 320,706 tons in December; pig iron, ferro manganese and spiegel production fell to 729,960 tons against 754,211 tons in December.

AMERICAN IRON AND STEEL INSTITUTE											
Capacity and Production for Sale of Iron and Steel Products											
January - 1942											
	Number of companies	Items	Annual Capacity Net tons (a)	PRODUCTION FOR SALE—NET TONS				Year to Date			
				Current Month		Shipments		Total		Shipments	
				Total	Per cent of capacity	Export *	To members of the industry for conversion into further finished products	Total	Per Cent of capacity	Export	To members of the industry for conversion into further finished products
STEEL PRODUCTS		Ingot, blooms, billets, slabs, sheet bars, etc.	41	1	595,529	xxx	167,829		xxx		
		Heavy structural shapes	9	2	5,047,000	403,215	94.0				xxxxxxx
		Steel piling	4	3	374,000	38,099	119.9				xxxxxxx
		Plates—Sheared and Universal	20	4	7,100,760	713,182	118.2			13,353	
		Skelp	7	5	xxxxxxx	83,550	xxx			53,605	
		Rails—Standard (over 60 lbs.)	4	6	3,563,600	123,263	40.7				xxxxxxx
		Light (60 lbs. and under)	6	7	302,800	8,019	31.2				xxxxxxx
		All other (Incl. girder, guard, etc.)	2	8	102,000	1,360	15.7				xxxxxxx
		Splice bar and tie plates	13	9	1,161,740	54,150	54.9				xxxxxxx
		Bars—Merchant	41	10	593,129	xxx	82,151		xxx		
		Concrete reinforcing—New billet	18	11	xxxxxxx	164,527	xxx		xxx		xxxxxxx
		Rerolling	12	12	xxxxxxx	17,023	xxx		xxx		xxxxxxx
		Cold finished—Carbon	23	13	xxxxxxx	111,545	xxx		xxx		xxxxxxx
		Alloy—Hot rolled	18	14	xxxxxxx	147,788	xxx		xxx		xxxxxxx
		Cold finished	18	15	xxxxxxx	19,377	xxx		xxx		xxxxxxx
		Hoops and baling bands	3	16	xxxxxxx	6,136	xxx		xxx		xxxxxxx
		TOTAL BARS	65	17	13,601,850	1,059,525	91.7			112,305	
		Tool steel bars (rolled and forged)	16	18	182,340	13,374	86.3				xxxxxxx
		Pipe and tube—B. W.	16	19	2,227,040	137,745	72.8				xxxxxxx
		L. W.	8	20	904,400	41,714	54.3				xxxxxxx
		Electric weld	7	21	1,165,450	56,331	56.9				xxxxxxx
		Seamless	13	22	3,031,160	162,565	63.1				xxxxxxx
		Conduit	8	23	186,280	14,792	93.5				xxxxxxx
		Mechanical Tubing	10	24	402,600	33,158	96.9				xxxxxxx
		Wire rods	20	25	xxxxxxx	110,354	xxx			17,590	
		Wire—Drawn	43	26	2,348,690	200,987	100.7			3,705	
		Nails and staples	19	27	1,157,650	61,478	62.5				xxxxxxx
		Barbed and twisted	15	28	469,810	26,666	66.8				xxxxxxx
		Woven wire fence	16	29	774,785	20,100	30.5				xxxxxxx
		Bale ties	11	30	120,930	5,480	53.3				xxxxxxx
		All other wire products	9	31	71,020	3,103	51.4				xxxxxxx
		Fence posts	11	32	107,160	3,020	33.2				xxxxxxx
		Black plate	11	33	342,100	51,877	178.5				
		Tin plate—Hot rolled	6	34	508,620	37,355	86.4				xxxxxxx
		Cold reduced	11	35	3,871,340	279,905	85.1				xxxxxxx
		Sheets—Hot rolled	28	36	xxxxxxx	543,996	xxx			13,945	
		Galvanized	15	37	xxxxxxx	111,326	xxx		xxx		xxxxxxx
		Cold rolled	16	38	xxxxxxx	205,391	xxx		xxx		xxxxxxx
		All other	13	39	xxxxxxx	47,866	xxx		xxx		xxxxxxx
		TOTAL SHEETS	30	40	13,088,370	908,579	81.7			13,945	
		Strip—Hot rolled	25	41	2,895,100	152,763	62.1			14,840	
		Cold rolled	40	42	1,589,380	100,962	74.8				xxxxxxx
		Wheels (car, rolled steel)	5	43	424,820	21,401	59.3				xxxxxxx
		Axles	6	44	453,470	20,261	52.6				xxxxxxx
		Track spikes	11	45	320,940	14,722	54.0				xxxxxxx
		All other	6	46	76,600	8,955	137.6				xxxxxxx
		TOTAL STEEL PRODUCTS	170	47	xxxxxxx	5,567,539	xxx			397,172	
IRON PRODUCTS		Pig iron, ferro manganese and spiegel	29	48	xxxxxxx	729,960	xxx			286,041	
		Ingot moulds	5	49	xxxxxxx	65,681	xxx			xxxxxxx	
		Bars	12	50	xxxxxxx	177,115	10,125	67.3		807	
		Pipe and tubes	3	51	xxxxxxx	109,300	7,589	81.7		xxxxxxx	
		All other	2	52	xxxxxxx	71,000	2,177	36.1			xxxxxxx
		TOTAL IRON PRODUCTS (ITEMS 50 to 52)	15	53	xxxxxxx	292,915	19,891	79.9		807	

Total number of companies included, 196.

During 1940 the companies included above represented 97.9% of the total output of finished rolled products.

(a) To be revised.

* In accordance with Government policy, export figures cannot be published.

PERSONALS

• **Russell Creighton**, formerly in charge of production engineering for the Bell Aircraft Corp., Buffalo, has been appointed special assistant to Lester L. Benson, works manager in charge of machine tool and equipment procurement; **Joseph P. Bauer**, formerly a tool-design specialist, will succeed Mr. Creighton. Also promoted are **Harry W. Ashburn**, formerly in charge of tool design, who has been named chief planning engineer, and **Harry L. Smeltzer**, former tool-design engineer, who will succeed Mr. Ashburn.

• **Edwin H. Brown** has been elected a vice-president of the Allis-Chalmers Mfg. Co., Milwaukee, in charge of engineering and development. In 1906, Mr. Brown entered the Allis-Chalmers training course for graduate engineers. He served in various capacities with the company, among them assistant manager of the steam turbine department. He became head of the engine and condenser section in 1935.

• **Walter H. Blocher** has been appointed assistant manager of sales of the Republic Steel Corp.'s Alloy Steel Division, Massillon, Ohio. Mr. Blocher joined the Central Alloy Steel Corp. in 1925. He was in the Indianapolis sales office of Central Alloy when this company became a part of Republic Steel in 1930. Subsequently Mr. Blocher was transferred to Republic's Pittsburgh district sales office, and, in 1939, to the company's Alloy Steel Division.

• **Robert B. Smith**, a member of Truscon Steel Co.'s Birmingham office since 1935, has been appointed Birmingham district sales manager for the company, succeeding **Jack Yauger**, a reserve officer, who has been called to active duty in the Army. Mr. Smith became associated with Truscon in 1928 when he was employed in the steel window engineering department at the company's home offices in Youngstown. Before coming to Birmingham, he also served in Truscon's Chicago and Atlanta district offices. Mr. Yauger was appointed Birmingham district sales manager in 1936.



RUSSELL CREIGHTON, recently named a special assistant for machine tool and equipment procurement for Bell Aircraft Corp.



EDWIN H. BROWN, who has been elected a vice-president of Allis-Chalmers Mfg. Co.

• **C. J. Stakel**, employed in the engineering and operating departments of Cleveland-Cliffs Iron Co. since 1905, has been made assistant manager of iron mines in the Lake Superior district. **Stanley W. Sundine** has been appointed assistant superintendent at the Cliffs shaft mine.

• **Ralph Kelly** who, since 1938, has been vice-president in charge of sales for Westinghouse Electric and Mfg. Co., has been elected executive vice-president and a director of Baldwin Locomotive Works.

Mr. Kelly began his association with Westinghouse as an apprentice in its Power Engineering Department in 1909. In 1934, he was appointed vice-president in charge of the operating division of Westinghouse centered around east Pittsburgh.

• **Frank S. MacGregor**, director of the priorities division of E. I. du Pont de Nemours & Co. since June, 1941, has replaced **Milton Kutz** as assistant general manager of the R. & H. Chemicals Department. Mr. Kutz, who has been assistant general manager since 1933, has been away for several months due to ill health and upon his return will become sales advisor and assistant to the general manager of the R. & H. Chemicals Department.

Mr. MacGregor worked as a metallurgist and consulting engineer before joining the Du Pont Company in 1916. Mr. Kutz, joined

the Roessler and Hasslacher Chemical Co. in 1897 as an office boy and became vice-president and a director. When that company was merged with Du Pont in 1930, he was made director of sales.

• **E. K. Smith**, for the past 11 years service metallurgist with the Electro Metallurgical Co., Detroit, has taken a leave of absence to become senior metallurgist, for the Industrial Service, Tank and Combat Vehicle Division, Army Ordnance Department, Washington. His wife, **Rebecca H. Smith**, has left her metallurgical office in Detroit to take up similar work at the Washington Navy Yard's Naval Gun Factory.

• **Alfred Marchev**, Chicago industrial executive, has joined Republic Aviation Corp. as assistant to the president.

Before joining Republic, Mr. Marchev was chief engineer, works manager and director of the Signode Steel Strapping Co., Chicago. Previously, he had been chief engineer and works manager for Ditto, Inc. In 1927 he organized and served, for several years, as president of the Temple Radio Corp. He pioneered in the production of gliders in Switzerland as early as 1908 and until recently was president of the Chicago Glider Club.

• **Robert D. Williams** has been named a research engineer on the technical staff of Battelle Memo-

rial Institute, Columbus, Ohio, where he will assist in the Institute's welding research.

Prior to joining Battelle, Mr. Williams was a member of the faculty in the department of Mechanical Engineering at the University of Illinois.

- **F. B. Bell** who has been president of Edgewater Steel Co., Pittsburgh, since its organization 25 years ago, has been elected chairman of the board, and **D. S. Bell** has been elected president. **M. A. Smith** was elected to the new office of vice-president and general manager. **J. F. Manns** was elected assistant secretary. **D. S. Bell** and **W. F. Carey** were elected directors. **F. B. Bell** has been devoting most of his time to work in the War Production Board.

- **C. P. Cutler** has been appointed assistant manager of the Chicago district for Republic Steel Corp.; **R. A. Hawkinson** has been named superintendent of finishing mills and special process department, and **J. C. Price** named assistant superintendent of the same department at the company's South works.

Mr. Cutler has been with the steel company since 1909, starting as an office boy with the Interstate Iron & Steel Co., now a part of Republic. In 1926 he was made works manager of the East Chicago plant, and later became superintendent of the finishing mills and special process department. Mr. Hawkinson began in 1915 as an engineer with Carnegie-Illinois Steel Corp. In 1919 he joined Interstate Iron & Steel Co. as field engineer, and in 1941 became assistant superintendent of finishing mills and special process department. Mr. Price became associated with the Michigan Central Railroad in 1912. In 1917 he joined the Canadian Steel Foundries Co. and after two years went with Louisville Steel & Iron Co., Louisville. In 1923 he was made foreman of the finishing mills of the then Interstate Iron & Steel Co. and has continued since in that capacity with Republic.

- **Bennett S. Chapple, Jr.**, has been appointed assistant to the vice-president, in charge of emergency defense coordination, Carnegie-Illinois Steel Corp., Pittsburgh. He formerly was in charge of the sales promotion activities of the company.

- **William S. Howe** will retire as president and treasurer of the Production Machine Co. of Greenfield, Mass., this month. Mr. Howe has been at the head of this company for 25 years, since its inception. In 1917 under his direction, the business of the J. C. Blevney Co. of Newark was purchased and brought to Greenfield. The Production Machine Co. was established to manufacture patented polishing machinery. Later the businesses of the Peerless Surfacing Machine Co., Troy, N. Y., and the Francis Reed Co., Worcester, Mass., were purchased and recently the Greenfield Tool and Cutter Grinders formerly made by the Greenfield Machine Co. and the Greenfield Tap and Die Corp. were added to the line. Mr. Howe will continue to operate Howe and Son, Hinsdale, N. H., of which he is the owner.

- **L. W. Oswald** has been appointed manager of the bar and semi-finished materials bureau, Carnegie-Illinois Steel Corp., Pittsburgh. He was formerly contact representative in the same bureau and he succeeds **H. A. Moorhead** who has been made metallurgical engineer, succeeding **F. T. Bumbaugh**.

- **William C. Boulcott** has been appointed acting manager of the Buffalo assembly plant of the Ford Motor Co. He succeeds **Alan B. Pease**, who has withdrawn as manager after 31 years with Ford. Mr. Boulcott has been assistant manager of the Buffalo plant since Jan. 1, previously having served as manager of the Green Island plant near Albany, N. Y. He has also worked in Minneapolis, Des Moines and Omaha.

- **Howard G. Waldron** has been appointed superintendent of foundries for the Nordberg Mfg. Co., Milwaukee. He is vice-president of the Wisconsin chapter, American Foundrymen's Association. He succeeds **John H. Champion** who retires after 30 years of service with Nordberg.

- **C. E. Frudden**, executive engineer with the tractor department of Allis-Chalmers Mfg. Co., Milwaukee, has resigned to become technical advisor to the Farm Equipment Section of the War Production Board at Washington. Mr. Frudden formerly was an engineer for the Hart-Parr Mfg. Co., Charles City, Iowa.

OBITUARY . . .

- **Walter Davidson**, president and general manager of the Harley-Davidson Motor Co., Milwaukee, died Feb. 7, aged 65 years. He was born in Milwaukee and went directly into the railroad shops as a machinist after his grammar school education was completed. He and his brothers, together with William Harley, then began the manufacture of motorized bicycles. The company grew until it claimed to be the largest motorcycle factory in the world.

- **Alan G. Wikoff**, editor-in-chief of the general publicity department of Union Carbide & Carbon Corp., New York, died in White Plains, N. Y., on Feb. 11, aged 46 years. For the last 17 years, Mr. Wikoff had been associated with Union Carbide & Carbon Corp., and previous to that he was for 6 years employed by McGraw-Hill Publishing Co.

- **J. Harvey Williams**, president of J. H. Williams & Co., New York and Buffalo, manufacturers of drop forgings and drop-forged tools, died in New York, Feb. 23. He would have been 60 years old March 22. Mr. Williams was born in Brooklyn, the elder son of James H. Williams, founder of J. H. Williams & Co. Following the death of his father in 1904 he became vice-president of the company, then in 1916, president, which office he has since continuously occupied. In 1923, when the Brooklyn plant was closed and its facilities consolidated with the present Buffalo Works, he moved to Buffalo. In 1930 he returned to New York when the company's general offices were established there.

- **John J. Kline**, vice-president of Wolverine Bolt Co., Detroit, died Feb. 16. He was born in Cleveland 67 years ago. Before the Wolverine Co. was formed, he was an official of the Ireland and Matthews Mfg. Co.

- **Idris R. Williams**, who planned construction of National Tube Co., Lorain, Ohio, for U. S. Steel Corp., died Feb. 3 aged 74 years. Mr. Williams made the formula for the first steel to be produced at the National Tube Co. furnaces and had been superintendent at the works, from which he retired in 1931 after about 50 years of service in the steel industry.

Open Hearth Operators Using More Iron Ore

Cleveland

••• The struggle of open-hearth operators to keep their furnaces going in spite of the shortage of scrap has resulted in using more iron ore mixed in with hot metal. At some plants it is reported that as much as 275 lbs. of iron ore have been used per ton of steel produced, and in one operation a furnace charged 150 tons of hot metal and 50 tons of iron ore with no scrap at all being added to the charge. Open-hearth engineers point out that the smaller amount of scrap available necessitates a higher ratio of pig iron being used in the open-hearth, and in some cases 75 per cent of the total charge has been hot pig iron, as compared with former practices when 55 per cent of hot metal, 40 per cent scrap and 5 per cent iron ore was a frequent open-hearth charge ratio.

So far as melting time is concerned, engineers report that the use of greater amounts of iron ore still permit an operating time close to the former practice. Thus, this adds one more reason to the explanation of why steel operating rates are so high despite the widely discussed scrap shortage. Yet, it may well play havoc with former estimates of how much iron ore will be required by the iron and steel industry in 1942 and 1943.

Nelson Announces Drive For Increased Production

••• In response to a letter from President Roosevelt asking for an increase in war production, Donald M. Nelson, head of the War Production Board, stated that a continuing national drive, designed not merely to increase production at once, but to keep stepping it up as war continues, was under way.

The principal aims of this drive are to increase production immediately in plants that now have war contracts and to convert other plants to war production as speedily and completely as possible. This will be made effective in a variety of ways, including (1) the stimulation of pooling and cooperative use of manufacturing equipment, especially machine tools, (2) recognition and awards for outstanding in-

Weekly Bookings of Construction Steel in Tons

Week Ended	Mar. 3,	Feb. 24,	Feb. 3,	Mar. 4,	Year to Date	
	1942	1942	1942	1941	1942	1941
Fabricated structural steel awards	18,200	25,810	22,600	11,100	236,560	298,025
Fabricated plate awards.....	600	0	300	360	6,450	26,305
Sheet steel piling awards.....	0	0	690	190	790	5,640
Reinforcing bar awards.....	39,250	15,000	24,925	14,400	311,225	93,690
Total letting of Construction Steel	58,100	40,810	48,515	26,050	455,075	423,660

dustrial accomplishment both by management and labor, and (3) establishment of a joint labor-management war plant committee plan which will consider suggestions from all quarters for increasing production and help demonstrate the importance of men in production.

Beginning last Monday evening, Mr. Nelson started a series of weekly radio discussions (9:45 p.m. Mondays on Blue network) to show the part that each person in the country plays in the production drive.

Eastern Pa. Salvage Campaign Under Way

Philadelphia

••• With the completion of its organization in the Eastern Pennsylvania area Tuesday, the Industrial Salvage Section of the Bureau of Industrial Conservation launched a broad program designed to "clean house" in industrial plants and large business houses of five states

and direct the accumulation of scrap collected into armament manufacture. The program will be executed by industrial organizations in Eastern Pennsylvania, Southern New Jersey, Delaware and parts of Maryland and New York under the leadership of the new Middle Eastern regional office of the Industrial Salvage Section.

Executive steering committees in each industrial center, organized under the direction of A. Meritt Simpson, regional coordinator of the section, will not only move scrap and waste of all kinds, but idle equipment, machines and buildings as well, to the mills and factories.

Steering committees consisting of top executives in major industries have already been organized in Philadelphia and Trenton, N. J. Subcommittees will carry the program into plants. Each member of the steering committee of a given industrial center is responsible for the appointment and supervision of a subcommittee in a specific field.

THE END OF AN AUTO BODY: Hydraulic baling presses like the one pictured here are busier now that auto graveyard scrap is being uncovered, but the nation's press capacity still has a long way to go before being completely occupied.



MACHINE TOOLS

... SALES, INQUIRIES AND MARKET NEWS

Hydraulic Shell Presses In Heavy Demand

Cleveland

... The intensified war production program continues swiftly on its way despite bottlenecks, shortages and sporadic labor trouble. As a result, orders being placed for war materials continue to increase in both variety and volume. Among recent developments was included the unconfirmed possibility that a plant will be built in Ohio by a leading aircraft company to turn out engines for training planes.

There has been such a demand for hydraulic presses for nosing shells that at present these machines are available on a six to seven months' delivery basis for A-1-a orders. The major reason for this delivery bottleneck is the

tightness in steel castings for the presses.



Female Workers Studied

Cincinnati

... With the problems of obtaining men employees in machine shops becoming increasingly complex, district manufacturers have been discussing, for some time, the question of employment of females in the plants. The reluctance that was noted during the last war toward the employment of women in machine tool plants has been largely dissipated by consideration of the increase in automatic machinery and the tremendous strides made in making machine tools more easily operated.

Some employee resistance to a

three shift day, six days a week has retarded the full installation of the so-called "Cincinnati plan" in one or two isolated instances in the district, although plans continue to be formulated for installation of this program. But here again, management meets the problem of finding full personnel to man all shifts.



Detroit Weighs Tool Needs

Detroit

... There are indications that the weight of machine tool orders has yet to be felt here. In view of the substantial placing of new contracts for military production, amounting to about three times as much since Pearl Harbor as in the preceding year and a half, the automotive industry and others (like refrigeration) have only well started their analyses of equipment requirements. How much can be drawn from existing plant facilities, and how much new equipment will be needed, have not yet been determined.



Slow Deliveries Blamed

Chicago

... Tardy delivery of machine tools was the greatest single reason given by manufacturers holding ordnance contracts for delays in meeting production schedules, according to figures recently obtained from the Chicago Ordnance District. Slightly over one-third of those who have fallen behind contend machine tools are the reason. However, this is not an indictment of the machine tool industry by any means. Ordnance officials admit that priorities are partly to blame.

This survey showed that 12 per cent of the manufacturers behind schedule claimed slow deliveries of small tools were to blame. Technical production problems, occasioned by unfamiliarity with war work are responsible for 14 per cent of the delays; and design and specification changes cause 8.5 per cent to fall behind schedule.



Every man in our armed forces is a user of springs, whether he fires a gun, drives a truck, or works an office machine. Equipping our forces for combat is big business—the biggest of all! That's why even B-G-R—with its two modern, automatically functioning spring plants—must produce springs with machine gun rapidity to keep step with other vital products needed for warfare.

B-G-R
SPRINGS
Wire Forms
Small Stampings

BARNES-GIBSON-RAYMOND

DIVISION OF ASSOCIATED SPRING CORPORATION
DETROIT & ANN ARBOR, MICHIGAN

NON-FERROUS METALS

... MARKET ACTIVITIES AND PRICE TRENDS

Light Metal Output Will Be Expanded

••• In conjunction with the program announced in the Feb. 19 issue to centralize supplies of aluminum, whereby the government will buy all excess stocks from manufacturers, William L. Batt, director of materials, WPB, announced a new program for the expansion of aluminum and magnesium production and fabricating facilities. The current program will provide for a total annual output of aluminum of 1,450,000,000 lb. This productive capacity will be increased to 2,100,000 lb. a year, which with Canadian imports, is scheduled to give the nation a top rate of more than 2,500,000 lb. of aluminum when the program is completed.

Production, domestically, in 1941 was 615,000,000 lb. and 1942 estimates are something over 1,000,000,000 lb. Present facilities will produce 850,000,000 lb.; those now under way, known as the first expansion program adopted last year, total 640,000,000 lb.; Canadian imports will total 450,000,000 lb. in 1943; and the present expansion program provides for an additional 640,000,000 lb.; making the total available supply, when all production is in operation, something close to 2,580,000,000 lb.

In addition to providing this vast amount of primary metal, fabricating facilities will be built to turn it into useful products. These facilities must also be able to handle large quantities of scrap recovered from fabricating processes, which are conservatively estimated at 15 per cent of primary production. This means an additional 400,000,000 lb. of recovered scrap must be remelted and reworked. In general, the cost of providing fabricating facilities for a given amount of aluminum is about twice that of providing production facilities from mining the ore clear through to the finished ingot.

Furthermore, the second expansion program alone, calling for 640,000,000 lb. of aluminum, requires an additional 1,500,000 tons of bauxite. To convert this into

1,300,000,000 lb. of alumina, there must be erected new plants for the manufacture of carbon electrodes, new electrolytic plants, sheet rolling, extrusion, casting, and forging plants, and plants for the production of synthetic cryolite and aluminum fluoride. This construction will require some 250,000 tons of steel; 1,000,000 kw. of electricity constantly available; and a great variety of other products in immense quantities. One 640,000,000 lb. program costs about \$350,000,000.

The magnesium expansion program, calling for an annual production of 725,000,000 lb., will be handled by six companies through DPC aid, upping the 400,000,000 lb. program now under construction. The current program, with a productive capacity of 54,000,000 lb. already completed, calls for 352,000,000 lb. made by electrolysis of

magnesium chloride and 48,000,000 lb. made by the Hansgirg carbo-thermal process. Further details of this expansion are given in the Assembly Line, on page 70.

The March lead pool was set at 15 per cent of the January output, providing about 7700 tons for emergency purposes, according to order M-38-f issued this week. The percentage has been unchanged from February, but the actual amount for specific allocation will be larger since the base period was changed from December, 1941, to January.

Tin arrivals during February from foreign sources amounted to about 5000 tons according to the Commodity Exchange, and sizable tonnages of concentrates are believed to have arrived for the Texas City smelter, both from the Far East and from Bolivia.

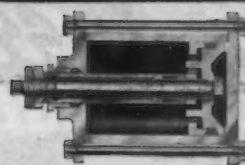
BETTER CYLINDER PERFORMANCE

Built-In

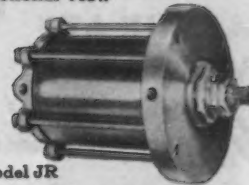
The demands of continuous production make cylinder design more important than ever before—and Hannifin cylinders give you the features that mean maximum use of air power, without leakage, with minimum friction loss and simplest maintenance. Hannifin pneumatic cylinders, including even the largest sizes, are bored and then honed, producing a cylinder bore, straight, round, perfectly smooth. Piston packing is adjustable from outside the cylinder, for easy maintenance of efficient piston seal.

Hannifin Pneumatic Cylinders are built in a full range of standard mounting types, sizes 1 to 16 in. diam., for any length stroke. Both single and double-acting types, with or without cushion. Write for Cylinder Bulletin 34-A.

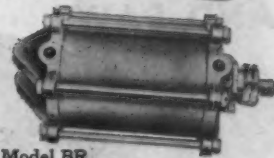
HANNIFIN MANUFACTURING COMPANY
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SCRAP

... MARKET ACTIVITIES AND PRICE TRENDS

Freight Car Jam, Lack of Burners Are New Threats

... A definitely better flow of scrap in major areas enabled the steel industry to bolster its operating schedules this week, but at the same time new obstacles appeared which threatened to blacken the outlook. The shortage of freight cars was becoming more pronounced this week. The nation-wide roundup of automobile graveyard scrap which had been expected to liquidate such yards in 60 to 90 days, was running into a stumbling block in the form of lack of "burners." Voluntary public scrap drives were growing more disappointing. The new steel differentials on tin can

scrap in bundles were hampering the collection of this material.

First reports in the WPA survey of graveyard scrap showed much available material waiting to be junked. At Birmingham 39 auto wreckers have 3258 old cars; in Missouri 803 auto yards revealed 12,600 tons of scrap; in Cleveland and 14 northeastern Ohio counties 213 yards have 16,722 junked cars, each of which will yield about 2/3 ton of scrap. The lack of "burners" who cut up the scrap may add months to the program for speedy disposal of jalopies, it appears now.

More and more, market interests are convinced the steep differentials on bundled tin can scrap must be eased. Despite all statements to the contrary, mills early this year were using huge quan-

tities of cans. But following the establishment of differentials several weeks ago, some dealers ceased handling the material, and mills rejecting bundles because of alleged high tin content saw the same scrap accepted by other steel producers. Instead of the present \$5 and \$8 differentials, experts advocate \$2 to \$3 per ton and suggest provisions making it discretionary for mills to use tin can scrap if they want to.

A five-point program and a plan for reorganization of the scrap iron industry were proposed at the recent annual convention of the Institute of Scrap Iron & Steel by Benjamin Schwartz, former director general of the Institute and now vice-president of Schiavone-Bonomo Corp. He urged the industry organize itself on a complete emergency basis to coordinate its efforts with those of war agencies. The program includes complete integration of the scrap industry in the various salvage programs sponsored by governmental agencies; industry self government and self discipline to assist in a compliance program; purchase of defense bonds; industry assistance in civilian defense; serious attention to post-war planning.

The House bill which would suspend operations of the tariff law, as pertaining to iron and steel scrap, for the duration of the emergency, was passed last week and sent to the Senate for action. Since its introduction the bill was amended to include relaying rail and rerolling rails. Imports of scrap largely originate in this hemisphere and during the past ten months were approximately 150,000 tons.

PITTSBURGH—Scrap collections came to a standstill here Tuesday because of a heavy snow fall. It looked as though several days would be lost in collections and shipments.

CHICAGO—A case of a manufacturer offering to sell borings and turnings direct to a mill and asking the mill to furnish a letter stating the scrap was worth more than the ceiling price, was reported in scrap circles here last week. Whether any mill furnished such a letter, or whether the scrap was actually sold in this manner is not known. Direct dealing is still heavy in this district. The industry shows signs of disturbance over the problems of dealing with householders if national "salvage" programs go through.

WASHINGTON—Domestic stocks of scrap at consumer, supplier, and producer plants at the end of October, 1941, approximated 4,698,000 gross tons, a decline of 8 per cent from the 5,104,000 tons reported on Sept. 30, according to the Bureau of Mines.

PHILADELPHIA—A freight car shortage in the Eastern Pennsylvania area is beginning to make itself felt in the movement of scrap. Cars loaded with war

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WELLS MANUFACTURING CORP., Three Rivers, Michigan

goods for export are held in yards and along sidings.

INDIANAPOLIS—Local street railway company has agreed to salvage 35 miles of rails for use as scrap for a local company producing tanks. It is estimated close to 5000 tons of rails will be realized. Cost of removal and cutting into two ft. sizes will total \$17 a ton. The company has agreed to donate an unnamed sum toward the restitution of streets torn up by the removal. When the same company removed rails last year, it contributed \$500 per mile toward replacing the street.

PITTSBURGH—Adverse weather conditions early this week slowed up scrap collections considerably and added to the tight situation current in the scrap market. Cutting of scrap in auto wrecking yards has been hampered recently by a scarcity of "burners," many of whom have been drafted, are in war factories, or are doing special work for the Army or Navy. No freight car shortages have been reported in the Pittsburgh district as yet, although there are cases where cars are not immediately available.

CLEVELAND—While dealers and brokers are visiting auto yards in this area to bid for unprepared scrap in cooperation with the Bureau of Industrial Conservation's attempt to clean out the auto graveyards, it is reported steel companies are quietly buying up whatever prepared scrap they are able to secure from such yard owners. This action continues a long chain of activities of steel mills, which are now practically in the scrap business. According to a WPA survey there are approximately 7900 tons of scrap available in auto graveyards in the Cleveland area. In Cleveland and 14 counties of northeastern Ohio, 213 yards have a total of 16,722 junked cars, each of which will yield approximately 2/3 ton of scrap. At the same time, it was reported by Samuel H. Urdang, president of the Northern Ohio Chapter of the Institute of Scrap Iron and Steel, that six auto graveyard owners had sold 960 tons of their scrap to the WPA's Bureau of Industrial Conservation in two days. As a whole, the flow of scrap continues better than it has for some months.

ST. LOUIS—A survey by WPA reveals 12,600 tons of scrap in 803 auto graveyards in Missouri, but the tonnage is disappointing to dealers here, who had expected it would be considerably larger. A statewide campaign to collect scrap from Missouri industries has been launched. It will be called the "Donald Nelson Salvage Campaign." Granite City Steel Co. took off three furnaces for repairs and because of the slowness of scrap.

CINCINNATI—The removal of some old rail from streets in Southern Ohio municipalities has eased temporarily the stricture in steel scrap, but the cast situation remains unchanged. A delegation of major foundry interests and scrap brokers discussed with Washington officials during the past week the question of re-

lief. The local problem has been further complicated by the opening of a foundry to manufacture castings for the Navy.

BOSTON—Material is coming into the market a little more freely since the weather has moderated, but shipments to consumers have not increased due to confusion regarding base prices. Southern New England shippers have been unofficially informed they must deduct the freight to the Providence or Bridgeport wharf, but are not going ahead until officially advised. Another sticker for a Providence shipper was an order received from a Pittsburgh mill for a tonnage f.o.b. New England. The question is shall the price be \$15.05 a ton Boston, \$14.16 from Providence, or \$14.06 outside the barge rate limits. The bid of the Associated Metals & Minerals Corp., New York, for the removal of the Atlantic Avenue Boston Elevated Railway elevated structure has been accepted. The New York firm's bids was \$49,100 to the railway company and removal handling charges. There is about 10,000 tons of steel and several thousand pounds of copper involved.

BUFFALO—Diminishing scrap reserves threaten further curtailment of operations at the district's largest steel plant, according to current reports. Near-zero

temperatures and heavy snow have cut down receipts and slowed yard operations. Bundled tin cans (incinerator-burned) are being accepted at only one steel plant here. About 100 tons of such cans are collected weekly by a junk dealer who has obtained exclusive rights to the city dumps for a fee of \$100 a week.

BIRMINGHAM—Thirty-nine auto graveyards containing 3258 old cars have been found in Birmingham and the nearby municipalities of Bessemer, Tuscaloosa and Anniston by the WPA. A complete report covering the number of old cars found in the entire state is expected to be made soon.

Cleveland Firm Adopts Philip Murray's Plan

Cleveland

•••The National Smelting Co. was the first war plant here to embrace Philip Murray's plan to stabilize labor relations and increase output through a "production for victory committee" representing the union and the management.



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PRICES

(All the prices given below are per gross ton and are basing point prices from which shipping point prices and consumer's delivered prices are to be computed)

IRON AND STEEL (OTHER THAN RAILROAD) SCRAP

	BASIC OPEN HEARTH GRADES (No. 1 Heavy Melting; No. 1 Hydr. Com- pressed Black Sheets; No. 2 Heavy Melting; Dealers' No. 1 Bundles; Dealers' No. 2 Bundles; No. 1 Busheling)			BLAST FURNACE GRADES (Mixed Borings and Turnings; Shovelling Turnings; No. 2 Busheling; Cast Iron Borings)			ELECTRIC FURNACE, ACID OPEN HEARTH AND FOUNDRY GRADES														
	Machine Shop Turnings			Low Phos.			Heavy Structural and Plate			Cut Auto. Steel Scrap			Alloy free Low Phos. and Sulphur Turnings	Heavy Axle and Forge Turn. First Cut	Electric Furnace Bundles						
				Billet, Bloom, Forge Crops	Bar Crops and Smaller	Punch- ings and Plate	3 ft. and Under	2 ft. and Under	1 ft. and Under	3 ft. and Under	2 ft. and Under	1 ft. and Under									
Pittsburgh, Brackenridge, Butler, Monessen, Midland, Johnstown, Sharon, Canton, Steubenville, Warren, Youngstown, Weirton.....	\$20.00	\$16.00	\$16.00	\$25.00	\$22.50	\$22.50	\$21.00	\$21.50	\$22.00	\$20.00	\$20.50	\$21.00	\$18.00	\$19.50	\$21.00						
Cleveland, Middletown, Cincinnati, Portsmouth.....	19.50	15.50	15.50	24.50	22.00	22.00	20.50	21.00	21.50	19.50	20.00	20.50	17.50	19.00	20.50						
Chicago, Claymont, Coatesville, Conshohocken, Harrisburg, Phoenixville, Sparrows Pt....	18.75	14.75	14.75	23.75	21.25	21.25	19.75	20.25	20.75	18.75	19.25	19.75	16.75	18.25	19.75	19.75					
Ashland, Ky.....	19.50	15.50	15.50	24.50	22.00	22.00	20.50	21.00	21.50	19.50	20.00	20.50	17.50	19.00	20.50	20.50					
Buffalo, N. Y.....	19.25	15.25	15.25	24.25	21.75	21.75	20.25	20.75	21.25	19.25	19.75	20.25	17.25	18.75	20.25	20.25					
Bethlehem, Pa.; Kokomo, Ind..	18.25	14.25	14.25	23.25	20.75	20.75	19.25	19.75	20.25	18.25	18.75	19.25	16.25	17.75	19.25	19.25					
Duluth, Minn.....	18.00	14.00	14.00	23.00	20.50	20.50	19.00	19.50	20.00	18.00	18.50	19.00	16.00	17.50	19.00	19.00					
Detroit, Mich.....	17.85	13.85	13.85	22.85	20.35	20.35	18.85	19.35	19.85	17.85	18.35	18.85	15.85	17.35	18.85	18.85					
Toledo, Ohio.....		13.85	13.85																		
St. Louis, Mo.....	17.50	13.50	13.50	22.50	20.00	20.00	18.50	19.00	19.50	17.50	18.00	18.50	15.50	17.00	18.50	18.50					
Atlanta, Ga.; Alabama City, Ala.; Birmingham, Los Angeles; Pittsburg, Cal.; San Francisco	17.00	13.00	13.00	22.00	19.50	19.50	18.00	18.50	19.00	17.00	17.50	18.00	15.00	16.50	18.00	18.00					
Minnequa, Colo.....	16.50	12.50	12.50	21.50	19.00	19.00	17.50	18.00	18.50	16.50	17.00	17.50	14.50	16.00	17.50	17.50					
Seattle, Wash.....	14.50	10.50	10.50	19.50	17.00	17.00	15.50	16.00	16.50	14.50	15.00	15.50	12.50	14.00	15.50	15.50					
Portland, Ore.....					15.50	15.50	14.00	14.50	15.00	13.00	13.50	14.00	11.00	12.50	14.00	14.00					

Bundles with less than 50% tin coated material are \$5 per gross ton below basic open hearth grades; those with more than 50% tin coated material are \$8 below basic open hearth grades.

PITTSBURGH basing point includes switching districts of Bessemer, Homestead, Duquesne, Munhall and McKeesport. Cincinnati basing point includes Newport, Ky., switching district. St. Louis includes switching districts of Granite City, East St. Louis, Madison, Ill. San Francisco includes switching districts of S. San Francisco, Niles and Oakland, Cal.

MAXIMUM prices of inferior grades shall continue to bear same differential below corresponding grades as existed during the period Sept. 1, 1940, to Jan. 31, 1941. Superior grades cannot be sold at a premium without approval of OPA. Special preparation charges in excess of the above prices are banned. Whenever any electric furnace or foundry grades are purchased for open hearth or blast furnace use, prices may not exceed the prices above for the corresponding open hearth grades.

MAXIMUM SHIPPING POINT PRICE—Where shipment is by rail or vessel, or by combination of rail and vessel, the scrap is at its shipping point when placed f.o.b. railroad car or f.a.s. vessel. In such cases, the maximum shipping point prices shall be: (a) For shipping points located within a basing point, the price listed in the table above for the scrap at the basing point in which the shipping point is located, minus the lowest established switching charge for scrap within the basing point and (b) for shipping points located outside the basing point, the price in table above at the most favorable basing point minus the lowest transportation charge by rail or water or combination thereof. Published dock charges prevail, or if unpublished 75c. per ton must be included as part of the deduction.* Shipping by motor vehicle: The scrap is at its shipping point when loaded. For shipping points located within basing points, take price listed in table minus lowest switching charge. If located outside a basing point, the price at the most favorable basing point minus lowest established charge for transporting by common carrier. If no established transportation rate exists, the customary costs are deducted. Published dock charges prevail. If unpublished include 75c.* For exceptions see official order.

*At Memphis deduct 50c.; Great Lakes ports \$1; New England \$1.25.

REMOTE SCRAP: Defined as all grades of scrap listed in table above located in North Dakota, South Dakota, Florida, Montana, Idaho, Wyoming, Nevada, Arizona, New Mexico, Texas, Oklahoma, Oregon and Utah. The delivered price of remote scrap may exceed by more than \$1, but not more than \$5, the price at the basing point nearest the consumer's plant, provided detailed statement under oath is furnished OPA. Where delivered price would exceed by more than \$5 the price at basing point nearest consumer, user must apply to OPA for permission to absorb the additional charges. For exceptions see official order.

UNPREPARED SCRAP: The maximum prices established hereinabove are maximum prices for prepared scrap. For unprepared scrap, maximum prices shall be \$2.50 less than the maximum prices for the corresponding grade or grades of prepared scrap. In no case, however, shall electric furnace and foundry grades be used as the "corresponding grade or grades of prepared scrap." Converter may charge \$2.50 per ton on consumer-owned unprepared remote scrap (see order).

Where scrap is to undergo preparation prior to its arrival at the point of delivery, such scrap is not at its shipping point, as that phrase is defined above, until after preparation has been completed.

CAST IRON BORINGS: (No more than 0.5 per cent oil content; for chemical use in explosive making) add \$5 to price of cast iron borings; for chemical use outside explosives making, add \$3.

UNPREPARED CAST IRON SCRAP—Except for heavy breakable cast, unprepared scrap is given a price ceiling of \$2.50 per ton less than the maximum prices for the corresponding grade of prepared cast iron scrap. Where scrap is to undergo preparation prior to arrival at the point of delivery, such scrap is not considered at shipping point until preparation is completed.

Consumers of cast scrap may pay the shipping point price plus established charge for transporting the scrap to their plants. In the case of deliveries by truck, the cast scrap buyer must obtain from the seller a certification, made out to OPA, of the shipping point, transportation charges and details of the sale.

RAILROAD SCRAP

(Per gross ton, delivered consumers' plants located on line.)

	Scrap Rails					
	No. 1 RR Heavy Melting	Scrap Rails	Rails for Rerolling	3 ft. and Under	2 ft. and Under	18 in. and Under
Cleveland, Cincinnati, Ashland, Portsmouth, Middletown.....	\$20.50	\$21.50	\$23.00	\$23.50	\$23.75	\$24.00
Canton, Pittsburgh, Sharon, Steubenville, Wheeling, Youngstown....	21.00	22.00	23.50	24.00	24.25	24.50
Chicago, Philadelphia, Sparrows Pt., Wilmington, Birmingham, Los Angeles, San Francisco.....	19.75	20.75	22.25	22.75	23.00	23.25
Buffalo.....	18.00	19.00	20.50	21.00	21.25	21.50
Detroit.....	20.25	21.25	22.75	23.25	23.50	23.75
Duluth.....	18.85	19.85	21.35	21.85	22.10	22.35
Kansas City, Mo.....	19.00	20.00	21.50	22.00	22.25	22.50
Kokomo, Ind.....	17.00	18.00	19.50	20.00	20.25	20.50
Seattle.....	19.25	20.25	21.75	22.25	22.50	22.75
St. Louis.....	15.50	16.50	18.00	18.50	18.75	19.00
	18.50	19.50	21.00	21.50	21.75	22.00

CAST IRON SCRAP

Other Than Railroad Scrap

	Group A	Group B	Group C
No. 1 cupola cast.....	\$18.00	\$19.00	\$20.00
No. 1 machinery cast, drop broken, 150 lbs. and under.....	18.00	19.00	20.00
Clean auto cast.....	18.00	19.00	20.00
Unstripped motor blocks.....	17.50	18.50	19.50
Stove Plate.....	17.00	18.00	19.00
Heavy Breakable Cast.....	15.50	16.50	17.50
Charging box size cast.....	17.00	18.00	19.00
Misc. Malleable.....	20.00	21.00	22.00

Group A includes the states of Montana, Idaho, Wyoming, Nevada, Utah, Arizona and New Mexico.

Group B includes the states of North Dakota, South Dakota, Nebraska, Colorado, Kansas, Oklahoma, Texas and Florida.

Group C: states not named in A and B; switch district of Kansas City, Kan., Mo.

... Comparison of Prices

(Advances Over Past Week in **Heavy Type**; Declines in *Italics*)

(Prices Are F.O.B. Major Basing Points)

Flat Rolled Steel: (Cents Per Lb.)	Mar. 3, 1942	Feb. 24, 1942	Feb. 3, 1942	Mar. 4, 1941
Hot rolled sheets	2.10	2.10	2.10	2.10
Cold rolled sheets	3.05	3.05	3.05	3.05
Galvanized sheets (24 ga.)	3.50	3.50	3.50	3.50
Hot rolled strip	2.10	2.10	2.10	2.10
Cold rolled strip	2.80	2.80	2.80	2.80
Plates	2.10	2.10	2.10	2.10
Stain's c.r. strip (No. 302)	28.00	28.00	28.00	28.00

Tin and Terne Plate: (Dollars Per Base Box)	Mar. 3, 1942	Feb. 24, 1942	Feb. 3, 1942	Mar. 4, 1941
Tin plate	\$5.00	\$5.00	\$5.00	\$5.00
Manufacturing ternes ...	4.30	4.30	4.30	4.30

Bars and Shapes: (Cents Per Lb.)	Mar. 3, 1942	Feb. 24, 1942	Feb. 3, 1942	Mar. 4, 1941
Merchant bars	2.15	2.15	2.15	2.15
Cold finished cars	2.65	2.65	2.65	2.65
Alloy bars	2.70	2.70	2.70	2.70
Structural shapes	2.10	2.10	2.10	2.10
Stainless bars (No. 302)	24.00	24.00	24.00	24.00

Wire and Wire Products: (Cents Per Lb.)	Mar. 3, 1942	Feb. 24, 1942	Feb. 3, 1942	Mar. 4, 1941
Plain wire	2.60	2.60	2.60	2.60
Wire nails	2.55	2.55	2.55	2.55

Rails: (Dollars Per Gross Ton)	Mar. 3, 1942	Feb. 24, 1942	Feb. 3, 1942	Mar. 4, 1941
Heavy rails	\$40.00	\$40.00	\$40.00	\$40.00
Light rails	40.00	40.00	40.00	40.00

Semi-Finished Steel: (Dollars Per Gross Ton)	Mar. 3, 1942	Feb. 24, 1942	Feb. 3, 1942	Mar. 4, 1941
Rerolling billets	\$34.00	\$34.00	\$34.00	\$34.00
Sheet bars	34.00	34.00	34.00	34.00
Slabs	34.00	34.00	34.00	34.00
Forging billets	40.00	40.00	40.00	40.00
Alloy blooms, billets, slabs	54.00	54.00	54.00	54.00

Wire Rods and Skelp: (Cents Per Lb.)	Mar. 3, 1942	Feb. 24, 1942	Feb. 3, 1942	Mar. 4, 1941
Wire rods	2.00	2.00	2.00	2.00
Skelp (grvd)	1.90	1.90	1.90	1.90

The various basing points for finished and semi-finished steel are listed in the detailed price tables, pages 136 to 144 herein. On export business there are frequent variations from the above prices. Also in domestic business, there is at times a range of prices on various products, as shown in our detailed price tables.

Pig Iron: (Per Gross Ton)	Mar. 3, 1942	Feb. 24, 1942	Feb. 3, 1942	Mar. 4, 1941
No. 2 fdy., Philadelphia...	\$25.84	\$25.84	\$25.84	\$25.84
No. 2, Valley furnace...	24.00	24.00	24.00	24.00
No. 2, Southern Cin'ti...	24.06	24.06	24.06	24.06
No. 2, Birmingham	20.38	20.38	20.38	19.38
No. 2, foundry, Chicago†	24.00	24.00	24.00	24.00
Basic, del'd eastern Pa...	25.34	25.34	25.34	25.34
Basic, Valley furnace ...	23.50	23.50	23.50	23.50
Malleable, Chicago†	24.00	24.00	24.00	24.00
Malleable, Valley	24.00	24.00	24.00	24.00
L. S. charcoal, Chicago...	31.34	31.34	31.34	30.34
Ferromanganese†	120.00	120.00	120.00	120.00

†The switching charge for delivery to foundries in the Chicago district is 60c. per ton.

†For carlots at seaboard.

Scrap: (Per Gross Ton)	Mar. 3, 1942	Feb. 24, 1942	Feb. 3, 1942	Mar. 4, 1941
Heavy melt'g steel, P'gh.	\$20.00	\$20.00	\$20.00	\$21.00
Heavy melt'g steel, Phila.	18.75	18.75	18.75	20.00
Heavy melt'g steel, Ch'go	18.75	18.75	18.75	19.50
No. 1 hy. comp. sheet, Det.	17.85	17.85	17.85	17.75
Low phos. plate, Youngs'n	23.00	23.00	23.00	24.00
No. 1 cast, Pittsburgh...	22.00	22.00	22.00	22.25
No. 1 cast, Philadelphia...	24.00	24.00	24.00	24.50
No. 1 cast, Ch'go*	21.00	21.00	21.00	19.75

*Changed to gross ton basis April 3, 1941.

Coke, Connellsville: (Per Net Ton at Oven)	Mar. 3, 1942	Feb. 24, 1942	Feb. 3, 1942	Mar. 4, 1941
Furnace coke, prompt...	\$6.00	\$6.00	\$6.125	\$5.50
Foundry coke, prompt...	6.875	6.875	6.875	5.75

Non-Ferrous Metals: (Cents per Lb. to Large Buyers)	Mar. 3, 1942	Feb. 24, 1942	Feb. 3, 1942	Mar. 4, 1941
Copper, electro., Conn.*	12.00	12.00	12.00	12.00
Copper, Lake, New York.	12.00	12.00	12.00	12.00
Tin (Straits), New York.	52.00	52.00	52.00	51.25
Zinc, East St. Louis....	8.25	8.25	8.25	7.25
Lead, St. Louis	6.35	6.35	6.35	5.60
Antimony (Asiatic), N. Y.	16.50	16.50	16.50	16.50

*Mine producers only.

... Composite Prices

FINISHED STEEL		PIG IRON		SCRAP STEEL	
March 3, 1942.....	2.30467c. a Lb.....	\$23.61 a Gross Ton.....	\$19.17 a Gross Ton.....	\$19.17 a Gross Ton.....	\$19.17 a Gross Ton.....
One week ago	2.30467c. a Lb.....	\$23.61 a Gross Ton.....	\$19.17 a Gross Ton.....	\$19.17 a Gross Ton.....	\$19.17 a Gross Ton.....
One month ago	2.30467c. a Lb.....	\$23.61 a Gross Ton.....	\$19.17 a Gross Ton.....	\$19.17 a Gross Ton.....	\$19.17 a Gross Ton.....
One year ago	2.30467c. a Lb.....	\$23.45 a Gross Ton.....	\$20.17 a Gross Ton.....	\$20.17 a Gross Ton.....	\$20.17 a Gross Ton.....

	High	Low	High	Low	High	Low
1941.....	2.30467c.,	2.30467c.,	\$23.61, Mar. 20	\$23.45, Jan. 2	\$22.00, Jan. 7	\$19.17, Apr. 10
1940.....	2.30467c., Jan. 2	2.24107c., Apr. 16	23.45, Dec. 23	22.61, Jan. 2	21.83, Dec. 30	16.04, Apr. 9
1939.....	2.35367c., Jan. 3	2.26689c., May 16	22.61, Sept. 19	20.61, Sept. 12	22.50, Oct. 3	14.08, May 16
1938.....	2.58414c., Jan. 4	2.27207c., Oct. 18	23.25, June 21	19.61, July 6	15.00, Nov. 22	11.00, June 7
1937.....	2.58414c., Mar. 9	2.32263c., Jan. 4	23.25, Mar. 9	20.25, Feb. 16	21.92, Mar. 30	12.92, Nov. 10
1936.....	2.32263c., Dec. 28	2.05200c., Mar. 10	19.74, Nov. 24	18.73, Aug. 11	17.75, Dec. 21	12.67, June 9
1935.....	2.07642c., Oct. 1	2.06492c., Jan. 8	18.84, Nov. 5	17.83, May 14	13.42, Dec. 10	10.33, Apr. 29
1934.....	2.15367c., Apr. 24	1.95757c., Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1933.....	1.95578c., Oct. 3	1.75836c., May 2	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932.....	1.89196c., July 5	1.83901c., Mar. 1	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July 5
1931.....	1.99629c., Jan. 13	1.86586c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930.....	2.25488c., Jan. 7	1.97319c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929.....	2.31773c., May 28	2.26498c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3

A weighted index based on steel bars, beams, tank plates, wire, rails, black pipe, hot and cold-rolled sheets and strip. These products represent 78 per cent of the United States output. This revised index recapitulated to 1929 in the Aug. 28, 1941, issue.

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

Prices of Finished Iron and Steel...

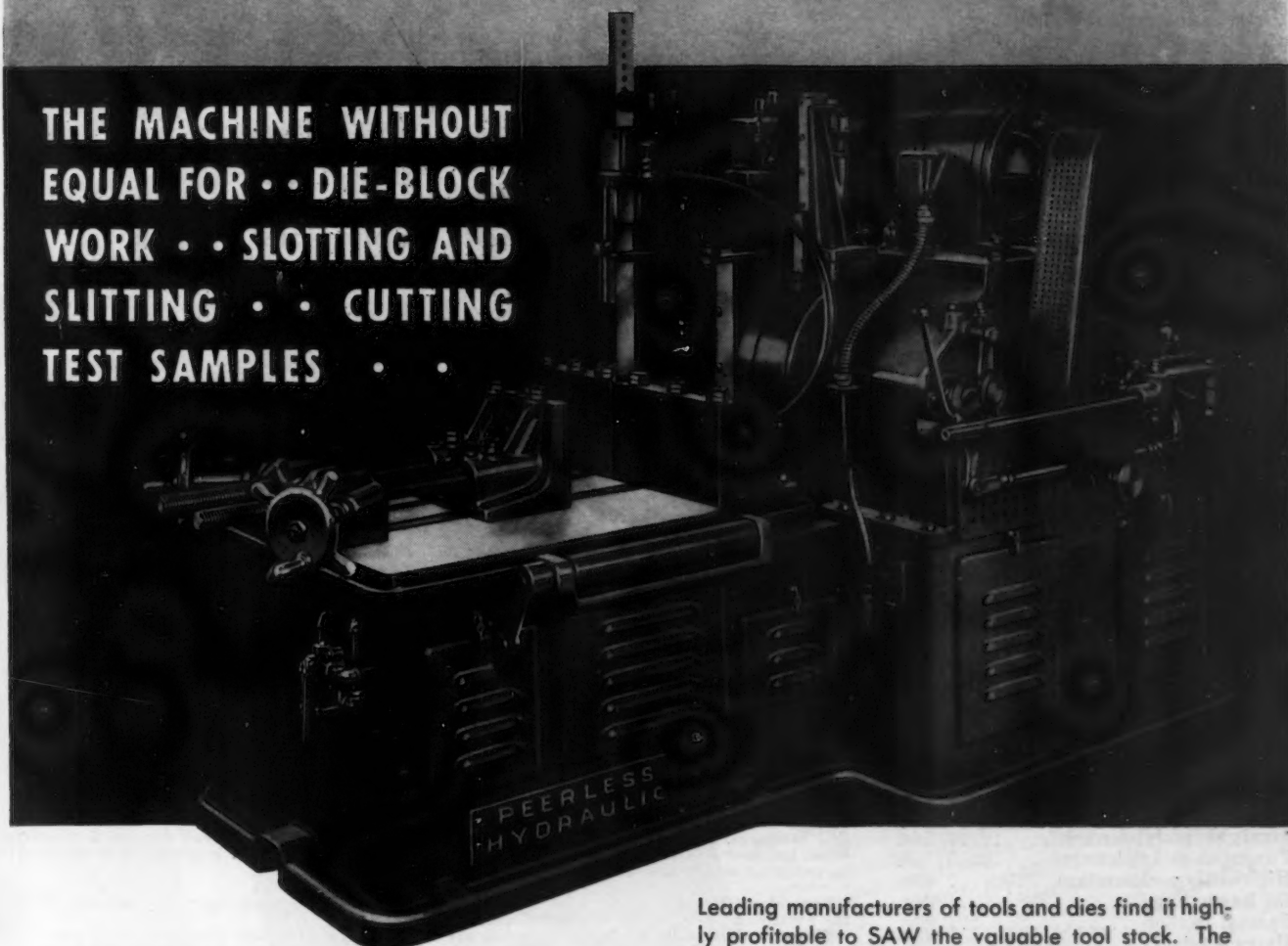
Steel prices shown here are f.o.b. basing points, in cents per lb., unless otherwise indicated. On some products either quantity deductions or quantity extras apply. In many cases gage, width, cutting, physical, chemical extras, etc., apply to the base price. Actual realized prices to the mill, therefore, are affected by extras, deductions, and in most cases freight absorbed to meet competition.

Basing Point ↓ Product													DELIVERED TO		
	Pittsburgh	Chicago	Gary	Cleveland	Birmingham	Buffalo	Youngstown	Sparrows Point	Granite City	Middletown, Ohio	Gulf Ports, Cars **	Pacific Ports, Cars **	Detroit	New York	Philadelphia
SHEETS															
Hot rolled	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.20¢	2.10¢		2.65¢	2.20¢	2.34¢	2.27¢
Cold rolled ¹	3.05¢	3.05¢	3.05¢	3.05¢		3.05¢	3.05¢		3.15¢	3.05¢		3.70¢	3.15¢	3.39¢	3.37¢
Galvanized (24 ga.)	3.50¢	3.50¢	3.50¢		3.50¢	3.50¢	3.50¢	3.50¢	3.60¢	3.50¢		4.05¢		3.74¢	3.67¢
Enameling (20 ga.)	3.35¢	3.35¢	3.35¢	3.35¢			3.35¢		3.45¢	3.35¢		4.00¢	3.45¢	3.71¢	3.67¢
Long ternes ²	3.80¢		3.80¢									4.55¢			
STRIP															
Hot rolled ³	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢			2.10¢		2.75¢	2.20¢	2.46¢	
Cold rolled ⁴	2.80¢	2.90¢					2.80¢	(Worcester=3.00¢)					2.90¢	3.16¢	
Cooperage stock	2.20¢	2.20¢			2.20¢		2.20¢							2.56¢	
Commodity C-R	2.95¢			2.95¢			2.95¢	(Worcester=3.35¢)					3.05¢	3.31¢	
TIN PLATE															
Standard cokes, base box	\$5.00	\$5.00	\$5.00						\$5.10						\$5.32
BLACK PLATE															
29 gage ⁵	3.05¢	3.05¢	3.05¢						3.15¢			4.05¢ (¹⁰)			3.37¢
TERNES, M'FG.															
Special coated, base box	\$4.30	\$4.30	\$4.30						\$4.40						
BARS															
Carbon steel	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢			(Duluth=2.25¢)		2.50¢	2.80¢	2.25¢	2.49¢	2.47¢
Rail steel ⁶	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢					2.50¢	2.80¢			
Reinforcing (billet) ⁷	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢			2.50¢	2.55¢	2.25¢	2.39¢	
Reinforcing (rail) ⁷	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢				2.50¢	2.55¢	2.25¢		2.47¢
Cold finished ⁸	2.65¢	2.65¢	2.65¢	2.65¢		2.65¢				(Detroit=2.70¢)				3.01¢	2.97¢
Alloy, hot rolled	2.70¢	2.70¢				2.70¢		(Bethlehem, Massillon, Canton=2.70¢)					2.80¢		
Alloy, cold drawn	3.35¢	3.35¢	3.35¢	3.35¢		3.35¢							3.45¢		
PLATES															
Carbon steel	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢	2.25¢(¹¹)		2.45¢	2.65¢	2.25¢	2.29¢	2.15¢
Wrought iron	3.80¢														
Floor plates	3.35¢	3.35¢									3.70¢	4.00¢		3.71¢	3.67¢
Alloy	3.50¢	3.50¢				(Coatesville=3.50¢)					3.95¢	4.15¢		3.70¢	3.37¢
SHAPES															
Structural	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢		(Bethlehem=2.10¢)			2.45¢	2.75¢		2.27¢	2.215¢
SPRING STEEL, C-R															
0.26 to 0.50 Carbon	2.80¢			2.80¢				(Worcester=3.00¢)							
0.51 to 0.75 Carbon	4.30¢			4.30¢				(Worcester=4.50¢)							
0.76 to 1.00 Carbon	6.15¢			6.15¢				(Worcester=6.35¢)							
1.01 to 1.25 Carbon	8.35¢			8.35¢				(Worcester=8.55¢)							
WIRE⁹															
Bright	2.60¢	2.60¢		2.60¢	2.60¢			(Worcester=2.70¢)				3.10¢			2.92¢
Galvanized	2.60¢	2.60¢		2.60¢	2.60¢			(Worcester=2.70¢)				3.10¢			2.92¢
Spring	3.20¢	3.20¢		3.20¢				(Worcester=3.30¢)				3.80¢			3.52¢
PILING															
Steel sheet	2.40¢	2.40¢				2.40¢						2.95¢			2.72¢
IRON BARS¹²															
Wrought single refined	4.40¢														
Wrought double refined	5.40¢														

¹ Mill run sheets are 10c. per 100 lb. less than base; and primes only, 25c. above base. ² Unassorted 8-lb. coating. ³ Widths up to 12 in. ⁴ Carbon 0.25 per cent and less. ⁵ Applies to certain width and length limitations. ⁶ For merchant trade. ⁷ Straight lengths as quoted by distributors. ⁸ Also shafting. For quantities of 20,000 to 39,999 lb. ⁹ Carload lot to manufacturing trade. ¹⁰ Boxed. ¹¹ Ship plates only. ¹² Common iron bars quoted at 2.15c. by Terre Haute, Ind., producer. ** Gulf and Pacific Ports prices shown here do not apply if the customary means of transportation (rail and water) is not used.

PEERLESS *HEAVY DUTY* VERTICAL SAW

THE MACHINE WITHOUT
EQUAL FOR • • DIE-BLOCK
WORK • • SLOTTING AND
SLITTING • • CUTTING
TEST SAMPLES • •



THIS Peerless-Vertical in a class by itself because of its smooth, accurate vertical cutting, and it is the only Saw with full hydraulic control — to the feed . . . blade lift . . . blade return . . . and elevating stock rollers.

The extension of the work table to 35" permits loading and removing the work by crane. Huge slabs of tool steel, as long as 24" and up to 10" in width, now can be Sawed through without turning the work.

Leading manufacturers of tools and dies find it highly profitable to SAW the valuable tool stock. The large, squarely-cut, scrap pieces are left available for smaller dies, strippers, and stripper plates.

Steel mills use the Peerless Vertical for cutting test samples from large billets.

Cutting-time estimates on any of your regular or special work will be mailed on request. A note on the coupon will bring a copy of the new bulletin No. 53.

PEERLESS MACHINE COMPANY, Racine, Wis.

Peerless
METAL SAWING MACHINES

PEERLESS MACHINE COMPANY, Dept. 1A-342, Racine, Wisconsin

Mail cutting time estimate for.....

- ☐ Mail catalog on Hydraulic type Saw for High Production Cutting
- ☐ Mail catalog covering Vertical type used for Die Block Work
- ☐ Mail catalog on Mechanical type Saw for production cutting
- ☐ Mail catalog on general utility and maintenance Saws

Company.....

Individual.....

Street.....

City..... State.....

FAST, ACCURATE CUTTING DEMANDS POSITIVE BLADE CONTROL

PRICES

SEMI-FINISHED STEEL

Billets, Blooms and Slabs

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point (rerolling only). Prices delivered Detroit are \$2 higher; f.o.b. Duluth, billets only, \$2 higher.

Per Gross Ton
Rerolling \$34.00
Forging quality 40.00

Shell Steel

Basic open hearth shell steel, f.o.b. Pittsburgh and Chicago.

Per Gross Ton
3 in. to 12 in. \$52.00
12 in. to 18 in. 54.00
18 in. and over 56.00

Note: The above base prices apply on lots of 1000 tons of a size and section to which are to be added extras for chemical requirements, cutting to length, or quantity.

Sheet Bars

Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

Per Gross Ton
Open hearth or bessemer \$34.00

Skelp

Pittsburgh, Chicago, Youngstown, Coatesville, Pa., Sparrows Point, Md.

Per Lb.
Grooved, universal and sheared 1.90c.

Wire Rods

(No. 5 to 9/32 in.) Per Lb.
Pittsburgh, Chicago, Cleveland. 2.00c.

Worcester, Mass. 2.10c.

Birmingham 2.00c.

San Francisco 2.50c.

Galveston 2.25c.

9/32 in. to 47/64 in., 0.15c. a lb. higher. Quantity extras apply.

Alloy Steel Blooms, Billets and Slabs

Per Gross Ton
Pittsburgh, Chicago, Canton, Massillon, Buffalo or Bethlehem \$54.00

TOOL STEEL

(F.o.b. Pittsburgh, Bethlehem, Syracuse) Base per Lb.

High speed 67c.

Straight molybdenum 54c.

Tungsten-molybdenum 57½c.

High-carbon-chromium 43c.

Oil hardening 24c.

Special carbon 22c.

Extra carbon 18c.

Regular carbon 14c.

Warehouse prices east of Mississippi are 2c. a lb. higher; west of Mississippi, 3c. higher.

WAREHOUSE PRICES

(Delivered Metropolitan areas, per 100 lb. See THE IRON AGE, Dec. 25, 1941, page 88, for details of OPA Price Schedule No. 49, covering steel resale prices. These prices do not necessarily apply for dislocated tonnage shipments when the f.o.b. city prices are used in conformance with Schedule 49.)

	Pittsburgh	Chicago	Cleveland	Philadelphia	New York	Detroit	Buffalo	Boston	Birmingham	St. Louis	St. Paul	Milwaukee	Los Angeles
Sheets, hot rolled	\$3.35	\$3.25	\$3.35	\$3.75	\$3.58	\$3.43	\$3.25	\$3.71	\$3.45	\$3.39	\$3.50	\$3.38	\$4.65
Sheets, cold rolled	.....	4.10	4.05	4.05	4.60	4.30	4.30	4.68	.....	4.24	4.90	4.23	6.85
Sheets, galvanized	4.65	4.85	4.62	5.00	5.00	4.84	4.75	5.11	4.75	4.99	5.00	4.98	5.85
Strip, hot rolled	3.60	3.60	3.50	3.95	3.96	3.68	3.82	4.06	3.70	3.74	3.85	3.73	5.00
Strip, cold rolled	3.20	3.50	3.20	3.31	3.51	3.40	3.52	3.46	.....	3.61	3.83	3.54	.....
Plates	3.40	3.55	3.40	3.55	3.76	3.60	3.62	3.85	3.55	3.69	3.80	3.68	4.50
Structural shapes	3.40	3.55	3.58	3.55	3.75	3.65	3.40	3.85	3.55	3.69	3.80	3.68	4.50
Bars, hot rolled	3.35	3.50	3.25	3.85	3.84	3.43	3.35	3.98	3.50	3.64	3.75	3.63	4.50
Bars, cold finished	3.65	3.75	3.75	4.06	4.09	3.80	3.75	4.13	4.43	4.02	4.34	3.88	6.60
Bars, ht. rld. SAE 2300	7.45	7.35	7.55	7.31	7.60	7.67	7.35	7.75	.....	7.72	7.45	7.58	9.55
Bars, ht. rld. SAE 3100	5.75	5.65	5.85	5.86	5.90	5.97	5.65	6.05	.....	6.02	6.00	5.88	8.55
Bars, cd. drn. SAE 2300	8.40	8.40	8.40	8.56	8.84	8.70	8.40	8.88	.....	8.77	8.84	8.63	10.55
Bars, cd. drn. SAE 3100	6.75	6.75	7.75	7.16	7.19	7.05	6.75	7.23	.....	7.12	7.44	6.98	9.55

BASE QUANTITIES: Hot rolled sheets, cold rolled sheets, hot rolled strip, plates, shapes and hot rolled bars, 400 to 1999 lb., galvanized sheets, 150 to 1499 lb.; cold rolled strip, extras apply on all quantities; cold finished bars, 1500 lb. and over; SAE bars, 1000 lb. and over. Exceptions: Chicago, galvanized sheets, 500 to 1499 lb.; Philadelphia, galvanized sheets, one to nine bundles, cold rolled sheets, 1000 to 1999 lb.; Detroit, galvanized sheets, 500 to 1499 lb.; Buffalo, cold rolled sheets, 500 to 1500 lb., galvanized sheets, 450 to 1499 lb., cold rolled strips, 0.0971 in. thick; Boston, cold rolled and galvanized sheets, 450 to 3749 lb.; Birmingham, hot rolled sheets, strip and bars, plates and shapes, 400 to 3999 lb., galvanized sheets, 500 to 1499 lb.; St. Louis, cold rolled sheets, 400 to 1499 lb., galvanized sheets, 500 to 1499 lb., cold rolled strip 0.095 in. and lighter; Milwaukee, cold rolled sheets, 400 to 1499 lb., galvanized sheets, 500 to 1499 lb., New York, hot rolled sheets, 0 to 1999 lb., cold rolled sheets, 400 to 1499 lb.; St. Paul, galvanized and cold rolled sheets, any quantity, hot rolled bars, plates, shapes, hot rolled sheets, 400 to 14,999 lb.; Los Angeles, hot rolled sheets, bars, plates, cold rolled sheets, 300 to 1999 lb.; galvanized sheets, 1 to 6 bundles; cold finished bars, 1 to 99 lb.; SAE bars, 100 lb. Extras for size, quality, etc., apply on above quotations. *12 gage and heavier, \$3.43.

PIG IRON

All prices set in bold face type are maxima established by OPA on June 24, 1941. Other domestic prices are delivered quotations per gross ton computed on the basis of the official maxima.

	No. 2 Foundry	Basic	Bessemer	Malleable	Low Phosphorous	Charcoal
Boston	\$25.50	\$25.00	\$26.50	\$26.00	.....	.....
Brooklyn	27.50	.....	.....	28.00	.....	.....
Jersey City	26.53	26.03	27.53	27.03	.....	.....
Philadelphia	25.84	25.34	26.84	26.34	.....	.....
Bethlehem, Pa.	\$25.00	\$24.50	\$26.00	\$25.50	.....	.....
Everett, Mass.	25.00	24.50	26.00	25.50	.....	.....
Swedeland, Pa.	25.00	24.50	26.00	25.50	.....	.....
Steelton, Pa.	.....	24.50	.....	.....	\$29.50	.....
Birdsboro, Pa.	25.00	24.50	26.00	25.50	29.50	.....
Sparrows Point, Md.	25.00	24.50	.....	.....	.....	.....
Erie, Pa.	24.00	23.50	25.00	24.50	.....	.....
Neville Island, Pa.	24.00	23.50	24.50	24.00	.....	.....
Sharpsville, Pa.*	24.00	23.50	24.50	24.00	.....	.....
Buffalo	24.00	23.00	25.00	24.50	29.50	.....
Cincinnati	24.44	24.61	.....	25.11	.....	.....
Canton, Ohio	25.39	24.89	25.89	25.39	.....	.....
Mansfield, Ohio	25.94	25.44	26.44	25.94	.....	.....
St. Louis	24.50	24.02	.....	.....	.....	.....
Chicago	24.00	23.50	24.50	24.00	.....	\$31.34
Granite City, Ill.	24.00	23.50	24.50	24.00	.....	.....
Cleveland	24.00	23.50	24.50	24.00	.....	.....
Hamilton, Ohio	24.00	23.50	.....	24.00	.....	.....
Toledo	24.00	23.50	24.50	24.00	.....	.....
Youngstown*	24.00	23.50	24.50	24.00	.....	.....
Detroit	24.00	23.50	24.50	24.00	.....	.....
Lake Superior fc.	.....	.....	.....	.....	.....	\$28.00
Lyles, Tenn. fc.†	.....	.....	.....	.....	.....	33.00
St. Paul	26.63	.....	27.13	26.63	.....	.....
Duluth	24.50	.....	25.00	24.50	.....	.....
Birmingham	20.38	19.00	25.00	.....	.....	.....
Los Angeles	27.50	.....	.....	.....	.....	.....
San Francisco	27.50	.....	.....	.....	.....	.....
Seattle	27.50	.....	.....	.....	.....	.....
Provo, Utah	22.00	.....	.....	.....	.....	.....
Montreal	27.50	27.50	.....	28.00	.....	.....
Toronto	25.50	25.50	.....	26.00	.....	.....

GRAY FORGE IRON

Valley or Pittsburgh furnace \$23.50

*Pittsburgh Coke & Iron Co. (Sharpsville, Pa., furnace only) and the Struthers Iron and Steel Co., Struthers, Ohio, may charge 50c. a ton in excess of basing point prices for No. 2 foundry, basic, bessemer and malleable. E. & G. Brooke Iron Co., Birdsboro, Pa., is permitted to charge \$1 in excess of maximums specified in Price Schedule No. 10.

Switching Charges: Basing point prices are subject to an additional charge for delivery within the switching limits of the respective districts.

Silicon Differentials: Basing point prices are subject to an additional charge not to exceed 50c. a ton for each 0.25 per cent silicon content in excess of base grade (1.75 per cent to 2.25 per cent).

Phosphorous Differential: Basing point prices are subject to a reduction of 38c. per ton for phosphorous content of 0.70 per cent and over.

†Price shown is for low-phosphorous iron; high-phosphorous sells for \$28.50 at the furnace.

Manganese Differentials: Basing point prices are subject to an additional charge not to exceed 50c. a ton for each 0.50 per cent manganese content in excess of 1.00 per cent.

ZINC IN WAR

5
CERAMICS

"AN ARMY MARCHES ON ITS STOMACH"

The United States armed forces are not only well fed, but a high degree of cleanliness is maintained in the preparation and serving of the food. White is the symbol of purity, and zinc pigments not only make paint whiter and more durable, they also serve in this capacity in tiling, porcelain enamelware and dishes in Army and Navy kitchens and mess halls.

Zinc oxide is used as a flux in ceramics to provide whiteness and gloss and to resist the shock of sudden temperature changes. Its presence prevents crazing of pottery and chipping of porcelain enamel. In ceramic manufacturing, zinc oxide provides such indispensable formulation features as fusibility, non-volatilization and wide temperature range.

When one considers the number of American soldiers, sailors and marines to be fed "three squares a day"—plus the fact that imports of European ceramic products have been cut off almost completely—the demands for zinc oxide by our ceramic industry can be appreciated.

This is just another one of the normal uses for zinc which has become greatly expanded by war needs—one more reason why civilian users may not be able to obtain all of the zinc they would like to use.

DIE
CASTING

METAL
SPRAYING

GALVAN-
IZING

PHARMA-
CEUTICALS

NICKEL
SILVER

1
HULL
PLATES

2
RUBBER

3
PAINT

4
BRASS

U. S. ARMY SIGNAL CORPS PHOTO
THE NEW JERSEY
MANUFACTURERS OF THE FAMOUS



ZINC COMPANY
HORSE HEAD ZINC PRODUCTS

PRICES

CORROSION AND HEAT- RESISTING STEELS

(Per lb. base price, f.o.b. Pittsburgh)

Chromium-Nickel Alloys

	No. 304	No. 302
Forging billets	21.25c.	20.40c.
Bars	25.00c.	24.00c.
Plates	29.00c.	27.00c.
Structural shapes	25.00c.	24.00c.
Sheets	36.00c.	34.00c.
Hot rolled strip	23.50c.	21.50c.
Cold rolled strip	30.00c.	28.00c.
Drawn wire	25.00c.	24.00c.

Straight-Chromium Alloys

	No. 410	No. 430	No. 442	No. 446
F. Billets 15.73c. 16.15c. 19.13c. 23.38c.				
Bars ..18.50c. 19.00c. 22.50c. 27.50c.				
Plates ..21.50c. 22.00c. 25.50c. 30.50c.				
Sheets ..26.50c. 29.00c. 32.50c. 36.50c.				
Hotstrip 17.00c. 17.50c. 24.00c. 25.00c.				
Cold st. 22.00c. 22.50c. 32.00c. 52.00c.				

Chromium-Nickel Clad Steel (20%)

	No. 304
Plates	18.00c.*
Sheets	19.00c.

* Includes annealing and pickling.

ELECTRICAL SHEETS

(Base, f.o.b. Pittsburgh)

	Per Lb.
Field grade	3.20c.
Armature	3.55c.
Electrical	4.05c.
*Motor	4.95c.
*Dynamo	5.65c.
Transformer 72	6.15c.
Transformer 65	7.15c.
Transformer 58	7.65c.
Transformer 52	8.45c.

Silicon strip in coils—Sheet price plus silicon sheet extra width extra plus 25c. per 100 lb. for coils. Pacific ports add 75c. per 100 lb.

* In some instances motor grade is referred to as dynamo grade and dynamo grade is referred to as dynamo special.

ROOFING TERNE PLATE

(F.o.b. Pittsburgh, per
Package of 112 Sheets)

	20x14 in.	20x28 in.
8-lb. coating I.C.	\$6.00	\$12.00
15-lb. coating I.C.	7.00	14.00
20-lb. coating I.C.	7.50	15.00
25-lb. coating I.C.	8.00	16.00
30-lb. coating I.C.	8.63	17.25
40-lb. coating I.C.	9.75	19.50

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)
Per Cent Off List

Machine and Carriage Bolts:

6½ in., shorter and smaller . . .	65½
6 x ¾ in., and shorter	63½
6 in. by ¾ to 1 in. and shorter .	61
1½ in. and larger, all length . .	59
All diameters over 6 in. long . .	59
Lag, all sizes	62
Plow bolts	65

Nuts, Cold Punched or Hot Pressed:

	(hexagon or square)
¾ in. and smaller	62
9/16 to 1 in. inclusive	59
1½ to 1½ in. inclusive	57
1½ in. and larger	56

On above bolts and nuts, excepting plow bolts, additional allowance of 10 per cent for full container quantities. There is an additional 5 per cent allowance for carload shipments.

Semi-Fin. Hexagon Nuts	U.S.S.	S.A.E.
7/16 in. and smaller	64	
½ in. and smaller	62	
¾ in. through 1 in.	60	
9/16 to 1 in.	59	
1½ in. through 1½ in.	57	58
1½ in. and larger	56	

In full container lots, 10 per cent additional discount.

Stove bolts, packages, nuts loose 71 and 10

Stove bolts in packages, with nuts attached 71

Stove bolts in bulk 80

On stove bolts freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago, New York lots of 200 lb. or over.

Large Rivets

(½ in. and larger)

Base per 100 lb.

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham \$3.75

Small Rivets

(7/16 in. and smaller)

Per Cent Off List

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham 65 and 5

Cap and Set Screws

Per Cent Off List

Upset hex. head cap screws U.S.S. or S.A.E. thread, 1 in. and smaller 60

Upset set screws, cup and oval points 68

Milled studs 40

Flat head cap screws, listed sizes 30

Filister head cap, listed sizes . . . 46

Freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago or New York on lots of 200 lb. or over.

WIRE PRODUCTS

(To the trade, f.o.b. Pittsburgh, Chicago, Cleveland, Birmingham)

Base per Keg

Standard wire nails \$2.55

Coated nails 2.55

Cutnails, carloads 3.85

Base per 100 Lb.

Annealed fence wire \$3.05

Base Column

Woven wire fence* 67

Fence posts (carloads) 69

Single loop bale ties 59

Galvanized barbed wire† 70

Twisted barbless wire 70

* 15½ gage and heavier. † On 80-rod spools in carload quantities.

Note: Birmingham base same on above items, except spring wire.

BOILER TUBES

Seamless Steel and Lap Weld Commercial

Boiler Tubes and Locomotive Tubes

Minimum Wall

(Net base prices per 100 ft., f.o.b. Pittsburgh, in carload lots)

Lap

Seamless Weld,

Cold Hot

Drawn Rolled Rolled

\$ \$ \$

2 in. o.d. 13 B.W.G. 15.03 13.04 12.38

2½ in. o.d. 12 B.W.G. 20.21 17.54 16.58

3 in. o.d. 12 B.W.G. 22.48 19.50 18.35

3½ in. o.d. 11 B.W.G. 28.37 24.62 23.15

4 in. o.d. 10 B.W.G. 35.20 30.54 28.66

(Extras for less carload quantities)

40,000 lb. or ft. over Base

30,000 lb. or ft. to 39,999 lb. or ft. 5%

20,000 lb. or ft. to 29,999 lb. or ft. 10%

10,000 lb. or ft. to 19,999 lb. or ft. 20%

5,000 lb. or ft. to 9,999 lb. or ft. 30%

2,000 lb. or ft. to 4,999 lb. or ft. 45%

Under 2,000 lb. or ft. 65%

STEEL AND WROUGHT IRON PIPE AND TUBING

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District
and Lorain, Ohio, Mills
(F.o.b. Pittsburgh only on wrought pipe)

Base Price = \$200 Per Net Ton

Steel (Butt Weld)

	Black	Galv.
½ in.	63½	51
¾ in.	66½	55
1 to 3 in.	68½	57½

Wrought Iron (Butt Weld)

½ in.	24	3½
¾ in.	30	10
1 and 1¼ in.	34	16
1½ in.	38	18½
2 in.	37½	18

Steel (Lap Weld)

2 in.	61	49½
2½ and 3 in.	64	52½
3½ to 6 in.	66	54½

Wrought Iron (Lap Weld)

2 in.	30½	12
2½ to 3½ in.	31½	14½
4 in.	33½	18
4½ to 8 in.	32½	17

Steel (Butt, extra strong, plain ends)

	Black	Galv.
½ in.	61½	50½
¾ in.	65½	54½
1 to 3 in.	67	57

Wrought Iron (Same as Above)

½ in.	25	6
¾ in.	31	12
1 to 2 in.	38	19½

Steel (Lap, extra strong, plain ends)

2 in.	59	48½
2½ and 3 in.	63	52½
3½ to 6 in.	66½	56

Wrought Iron (Same as Above)

2 in.	33½	15½
2½ to 4 in.	39	22½
4½ to 6 in.	37½	21

On butt weld and lap weld steel pipe jobbers are granted a discount of 5%. On less-than-carload shipments prices are determined by adding 25 and 30% and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount or \$4 a ton higher than Pittsburgh or Lorain on lap weld and one point lower discount, or \$2 a ton higher on all butt weld 8 in. and smaller.

CAST IRON WATER PIPE

Per Net Ton

6-in. and larger, del'd Chicago . . \$54.80

6-in. and larger, del'd New York 52.20

6-in. and larger, Birmingham . . 46.00

6-in. and larger f.o.b. dock, San

Francisco or Los Angeles or

Seattle 56.00

Class "A" and gas pipe, \$3 extra; 4-in. pipe is \$3 a ton above 6-in. Prices shown are for lots of less than 200 tons. For 200 tons or over, 6-in. and larger is \$45 at Birmingham and \$53.80 delivered Chicago.

FUEL OIL

No. 3, f.o.b. Bayonne, N. J. 5.20c.

No. 6, f.o.b. Bayonne, N. J. 3.21c.

No. 6 Bur. Stds., del'd Chicago . . 4.50c.

No. 3 distillate del'd Cleveland . . 6.50c.

No. 4 indus., del'd Cleveland . . . 6.00c.

No. 6 indus., del'd Cleveland . . . 5.00c.



Chrome-Moly cast iron keeps high temperature costs down

Automotive exhaust manifolds must have resistance to growth, and good strength at elevated temperatures. Competitive conditions demand minimum costs.

An iron containing about 3.30% C — 2.20% Si — 0.70% Mn — 0.60% Cr — and 0.60% Mo does the trick, while holding down foundry and machining costs.

This Chromium-Molybdenum combination is char-

acterized by high strength and toughness at the working temperatures encountered in exhaust manifolds. Its growth resistance prevents warpage and cracking — saves gaskets.

Send for our free technical book, "Molybdenum in Cast Iron," giving detailed data on Molybdenum irons of interest to production engineers and executives.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS. MOLYBDIC OXIDE—BRIQUETTES FOR THE CUPOLA • FERROMOLYBDENUM FOR THE LADLE

Climax Molybdenum Company
500 Fifth Avenue • New York City

FERROALLOYS

Ferromanganese

F.o.b. New York, Philadelphia, Baltimore, Mobile or New Orleans, Domestic, 80%, per gross ton (carloads).....\$120.00

Spiegeleisen

Per Gross Ton Furnace

Domestic, 19 to 21%.....\$36.00
Domestic, 26 to 28%..... 49.50

Electric Ferrosilicon

(Per Gross Ton, Delivered Lump Size)

50% (carload lots, bulk).....\$74.50
50% (ton lots, packed)..... 87.00
75% (carload lots, bulk).....135.00
75% (ton lots, packed).....151.00

Silvery Iron

(Per Gross Ton, base 6.00 to 6.50 \$t)

F.O.B. Jackson, Ohio.....\$29.50*
Buffalo30.75*
For each addition 0.50% silicon add \$1 a ton. For each 0.50% manganese over 1% add 50c. a ton. Add \$1 a ton for 0.75% phosphorus or over.
*Official OPACS price established June 24.

Bessemer Ferrosilicon

Prices are \$1 a ton above Silvery Iron quotations of comparable analysis.

Ferrochrome

(Per Lb., Contained Cr, Delivered Carlots, Lump Size, on Contract)

4 to 6 carbon.....13.00c.
2 carbon19.50c.
1 carbon20.50c.
0.10 carbon22.50c.
0.06 carbon23.00c.

Spot prices are ¼c. per lb. of contained chromium higher.

Silico-Manganese

(Per Gross Ton, Delivered, Lump Size, Bulk, on Contract)

3 carbon\$113.00*
2.50 carbon 118.00*
2 carbon 123.00*
1 carbon 133.00*

Other Ferroalloys

Ferrotungsten, per lb. contained W, del'd carload....\$ 2.00
Ferrotungsten, 100 lb. and less 2.25
Ferrovanadium, contract, per lb. contained V, del'd \$2.70 to \$2.90†
Ferrocolumbium, per lb. contained Cb, f.o.b. Niagara Falls, N. Y., ton lots..... \$2.25†
Ferrocarbontitanium, 15-18 Ti, 7-8 C, f.o.b. furnace, carload, contract, net ton\$142.50
Ferrocarbontitanium, 17-20 Ti, 3-5 C, f.o.b. furnace, carload, contract, net ton\$157.50

Ferrophosphorus, electric or blast furnace material, carloads, f.o.b. Anniston, Ala., for 18%, with \$3 unitage freight, equalized with Rockdale, Tenn., gross ton..... \$58.50

Ferrophosphorus, electrolytic 23-26%, carlots, f.o.b. Monsanto (Siglo), Tenn., \$3 unitage, freight equalized with Nashville, gross ton..... \$75.00

Ferromolybdenum, per lb. Mo, f.o.b. furnace 95c.

Calcium molybdate, per lb. Mo, f.o.b. furnace 80c.

Molybdenum oxide briquettes 48-52 Mo, per lb. contained Mo, f.o.b. Langeloth, Pa.... 80c.

Molybdenum oxide, in cans, per lb. contained Mo, f.o.b. Langeloth, and Washington, Pa. 80c.

*Spot prices are \$5 per ton higher.
†Spot prices are 10c. per lb. of contained element higher.

ORES

Lake Superior Ores (51.50% Fe.)

(Delivered Lower Lake Ports)

Per Gross Ton
Old range, bessemer, 51.50.....\$4.75
Old range, non-bessemer, 51.50. 4.60
Mesaba, bessemer, 51.50..... 4.60
Mesaba, non-bessemer, 51.50.... 4.45
High phosphorus, 51.50..... 4.35

Foreign Ores*

(C.i.f. Philadelphia or Baltimore, Exclusive of Duty)

Per Unit
African, 46-48 Mn.....66.5c. to 68c.
Indian, 48-50 Mn.68c. to 70c.

Brazilian, 46-48 Mn.....67c. to 68c.
Cuban, 51 Mn.81c.

Per Short Ton Unit

Tungsten, Chinese, Wolframite, duty paid, delivered....\$24 to \$26
Tungsten, domestic scheelite, at mine\$24.00 to \$25.00
Chrome ore, lump, c.i.f. Atlantic Seaboard, per gross ton; South African (low grade) ..\$28.00
Rhodesian, 45Nom.
Rhodesian, 48Nom.

*Importations no longer readily available. Prices shown are nominal.

COKE*

Furnace

Per Net Ton

†Connellsville, prompt\$6.00

Foundry

†Connellsville, prompt..\$6.75 to \$7.00

*Maximum by-product coke prices established by OPA became effective Oct. 1, 1941. A complete schedule of the ceiling prices was published in THE IRON AGE, Sept. 25, p. 94B. Maximum beehive furnace coke prices established by OPA, Jan. 26. †F.O.B. oven.

By-product, Chicago\$12.25
By-product, New England....\$13.75
By-product, Newark..\$12.40 to \$12.95
By-product, Philadelphia\$12.38
By-product, Cleveland\$12.30
By-product, Cincinnati\$11.75
By-product, Birmingham\$8.50†
By-product, St. Louis.....\$12.02
By-product, Buffalo\$12.50

RAILS, TRACK SUPPLIES

(F.o.b. Mill)

Standard rails, heavier than 60 lb., gross ton.....\$40.00
Angle bars, 100 lb..... 2.70
(F.o.b. Basing Points) Per Gross Ton
Light rails (from billets).....\$40.00
Light rails (from rail steel)... 39.00

Base per Lb.

Cut spikes 3.00c.
Screw spikes 5.15c.
Tie plates, steel 2.15c.
Tie plates, Pacific Coast..... 2.30c.
Track bolts, heat treated, to railroads 5.00c.
Track bolts, jobbers discount.. 63-5

Basing points, light rails—Pittsburgh, Chicago, Birmingham; spikes and tie plates—Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minneaqua, Colo., Birmingham and Pacific Coast ports; tie plates alone—Steelton, Pa., Buffalo; spikes alone—Youngstown, Lebanon, Pa., Richmond, Va.

FLUORSPAR

Fire Clay Brick

Per Net Ton

Domestic washed gravel, 85-5 f.o.b. Kentucky and Illinois mines, all rail\$25.00
Domestic, f.o.b. Ohio River landing barges 25.00
No. 2 lump, 85-5 f.o.b. Kentucky and Illinois mines 25.00
Foreign, 85% calcium fluoride, not over 5% Si, c.i.f. Atlantic ports, duty paid.....Nominal
Domestic No. 1 ground bulk, 96 to 98%, calcium fluoride, not over 2½% silicon, f.o.b. Illinois and Kentucky mines....\$34.00
As above, in bags, f.o.b. same mines 36.40

REFRACTORIES

(F.o.b. Works)

Fire Clay Brick

Per 1000

Super-duty brick, St. Louis...\$64.60
First quality, Pennsylvania, Maryland, Kentucky, Missouri and Illinois 51.30
First quality, New Jersey.... 56.00
Second quality, Pennsylvania, Maryland, Kentucky, Missouri and Illinois 46.55
Second quality, New Jersey... 51.00
No. 1, Ohio..... 43.00
Ground fire clay, net ton..... 7.60

Silica Brick

Pennsylvania\$51.30
Chicago District 58.90
Birmingham 51.30
Silica cement, net ton (Eastern) 9.00

Chrome Brick

Per Net Ton

Standard, f.o.b. Baltimore, Plymouth Meeting and Chester...\$54.00
Chemically bonded, f.o.b. Baltimore, Plymouth Meeting and Chester, Pa. 54.00

Magnesite Brick

Standard f.o.b. Baltimore and Chester\$76.00
Chemically bonded, f.o.b. Baltimore 65.00

Grain Magnesite

Domestic, f.o.b. Baltimore and Chester in sacks.....\$44.00
Domestic, f.o.b. Chewelah, Wash. (in bulk) 22.00